Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

JANUARY, 1959

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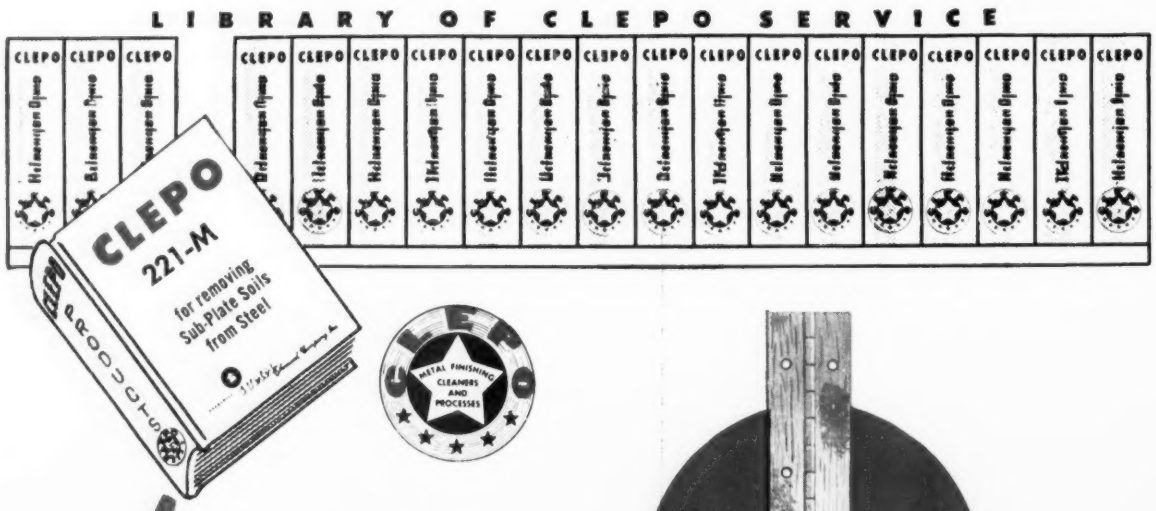
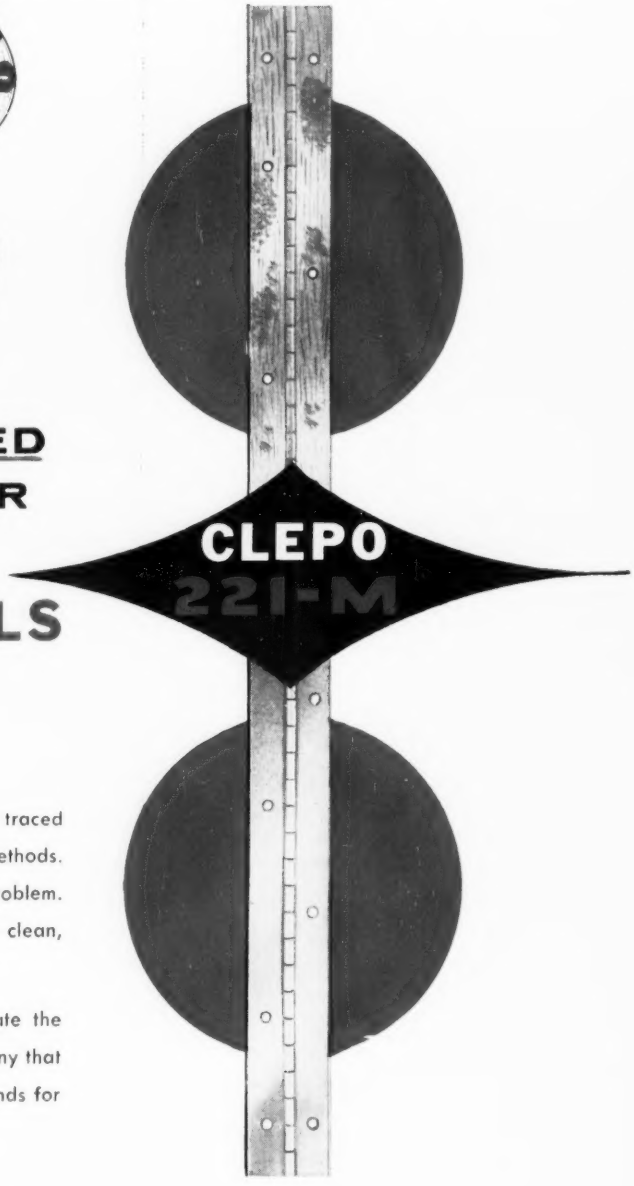
Read and pass on —



CLEPO
METAL FINISHING CLEANERS AND PROCESSES

Announcing

A NEW AND PROVED ELECTRO-CLEANER FOR REMOVING SUB-PLATE SOILS FROM STEEL



Many of the steel-plating troubles of today can be traced back to sub-plate soils that defy the usual cleaning methods. CLEPO 221-M has been developed to answer this problem. By loosening surface smuts and films, it produces a clean, white steel base which helps to produce quality plate.

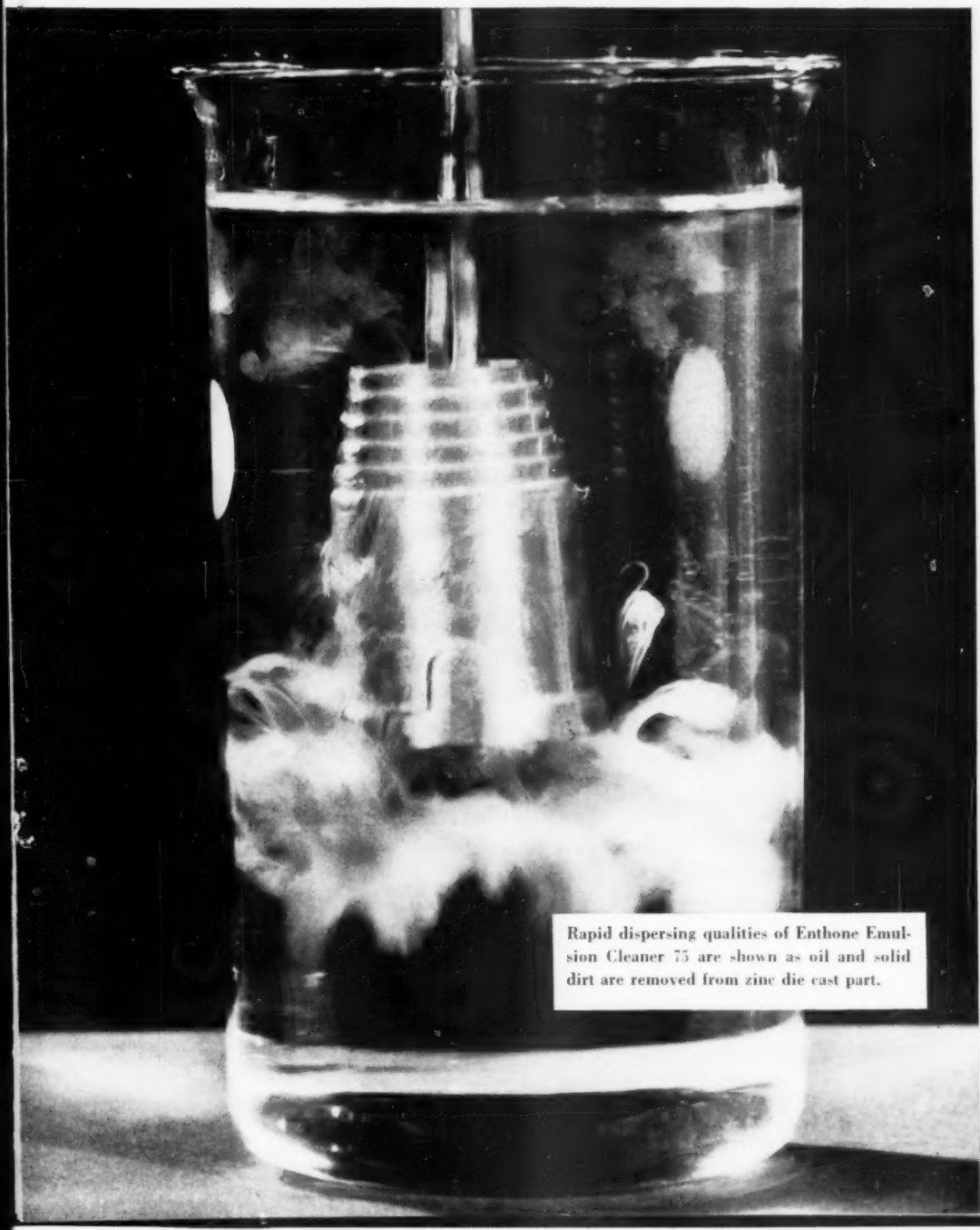
Ask to have a CLEPO Field Service Man demonstrate the effectiveness of CLEPO 221-M, the product of a company that has been developing and marketing cleaning compounds for more than twenty-five years.

FREDERICK

GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

How to make metal cleaning an exact science: Enthone's broad range of cleaning and degreasing compounds are the end result of more than 20 years of applied research in the laboratory and in the field on metal finishing problems. These compounds include emulsifiable and solvent cleaners, alkaline cleaners for soak or electrolytic cleaning of iron, steel, copper, brass, zinc and zinc base die castings. And if there's no Enthone stock cleaner that meets your requirements, Enthone will develop a special one that does. Write us about it. Enthone, Inc., 442 Elm St., New Haven 11, Conn.



Rapid dispersing qualities of Enthone Emulsion Cleaner 75 are shown as oil and solid dirt are removed from zinc die cast part.

ENTHONE

ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

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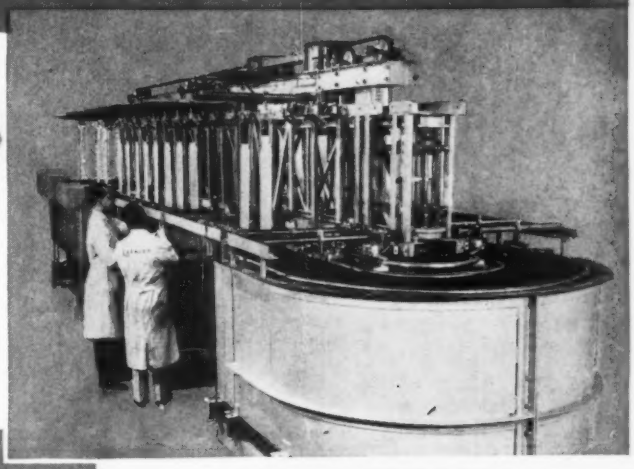
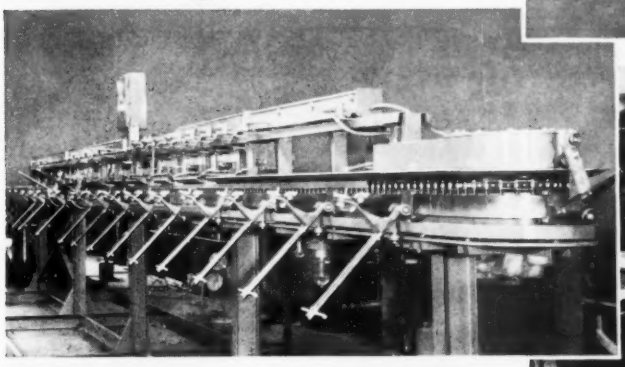
SECOND CLASS POSTAGE PAID at the Post Office in Westwood, N. J. and New York, N. Y. Volume 57, No. 1, January 1959. Five dollars per year.

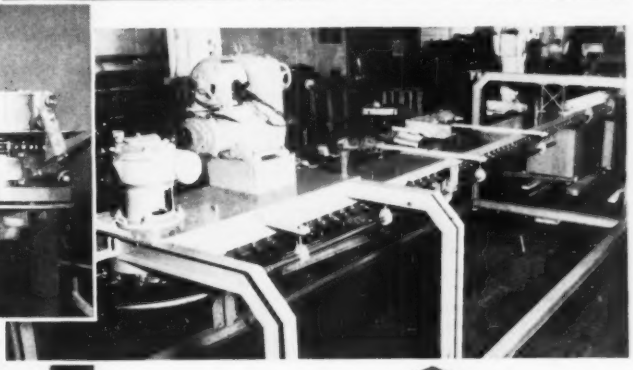
LASALCO has an automatic for any plating or anodizing operation!

CYCLEFLEX Full Automatic Plating & Anodizing Machine.
Most versatile of all automatics! No overhaul or rebuilding to switch cycles—just a simple moving in positions of pick-up heads and minor changes in tank partitions. Safety controls prevent conveyor breakdowns and load dropping. Many adaptations for any requirement. Low headroom.

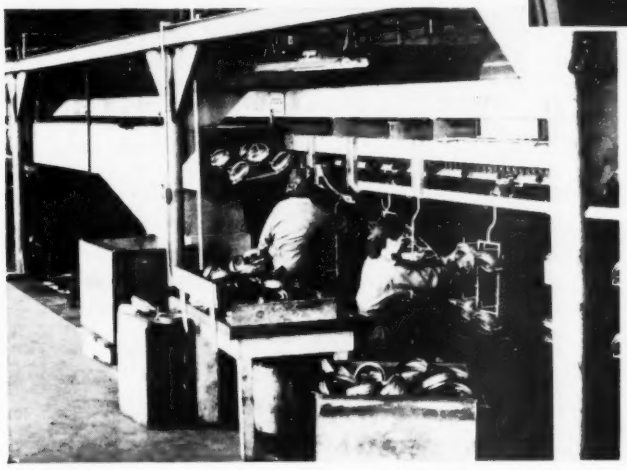


SELECT-O-MATIC Multiple Process Plater.
Handles 2, 3 or more process cycles at one time! While loading, operator merely turns dial to select desired cycle for individual racks and the rest is fully automatic! One operator can handle several different processes simultaneously. Saves investment in a variety of machines—reduces floor space requirements—cuts maintenance to a minimum.





DAW JUNIOR CONVEYOR
Fully automatic handling of individual parts. Tailor-made for any production output and any cycle. Tank to tank work transfers raise carriers to above horizontal to prevent solution carry-over, and eliminate air or gas pockets in work. Automatic unloading if work permits.



DAW SENIOR CONVEYOR
Custom-engineered, fully automatic, for any job, any cycle, any production requirement. Transfers from one tank to another raises work from vertical to above horizontal to facilitate drainage, prevent solution dragout. Handles racks for all sizes and quantities of parts. Automatic unloading unless shape or work size is too large.

Write For Descriptive Literature

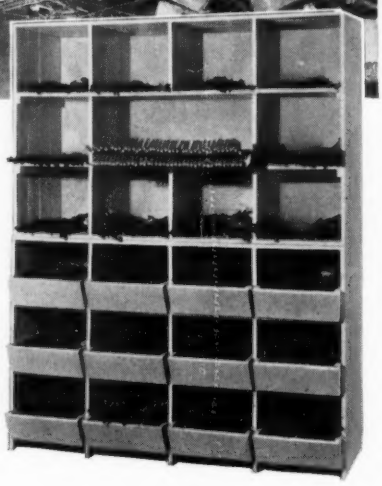
● Lasalco has the sound experience and proved ability to analyze your exact needs, and to give you equipment that will increase output do it better, faster, and far more profitably. Phone or write for the services of a Lasalco engineer.

LASALCO, INC.

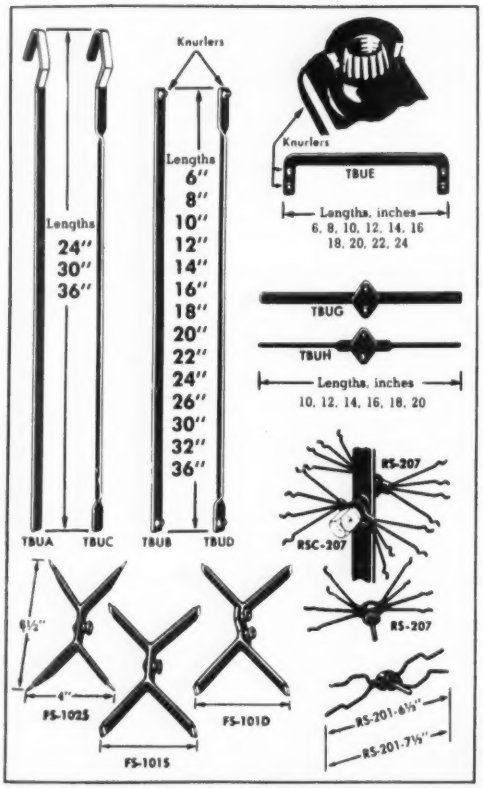
HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990
IN TEXAS: 2805 Allen Street • Dallas, Texas • Riverside 7-5814

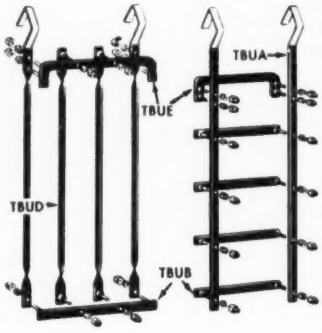
How to Convert Waste into PROFIT with Thinker Boy Plating Racks

Does your shop have a pile of discarded racks like this?



If so you can save PLENTY with Thinker Boy Racks.





Thinker Boy Plating Racks are made of mass-produced insulated parts that assemble with a leakproof seal.

When no longer needed you can disassemble the racks and reuse the parts or store the parts for future use in surprisingly small space.

With a supply of Thinker Boy Parts you can assemble fully insulated racks of your own design in minutes.

When you use Thinker Boy Racks you can quickly replace damaged tips with leakproof insulation seal–keep racks in service at full capacity–no dipping or waiting.

These great economies are possible because Thinker Boy Racks are made of standard, precoated parts assembled with screws. Disassembly or conversion to other styles is fast, easy and extremely practical.

A new illustrated bulletin, just off the press, shows how to make racks designed with Thinker Boy Sections. Send for your copy today — it's the key to revolutionary reduction in plating rack costs.

Ask your BELKE Service Engineer or send for illustrated bulletin.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

Harshaw PERFLOW PERGLOW DUPLEX Nickel Plating Process

The FIRST accepted by the plating industry.

Over 500,000 gallons in successful operation for more than 3 years.

After ten years of research and development, and more than 3 years of production experience, The Harshaw Chemical Company offers a new nickel process answering a major problem of the electroplating industry. You can now deposit *economically* a nickel coating that has high leveling, full brightness, excellent ductility, and most important, superior corrosion resistance. *Only the Harshaw Perflow-Perglow Duplex Nickel Plating Process can provide all of the above characteristics.*

Excellent Corrosion Protection Through Use of a Sulfur-Free Deposit
Years of research work performed by The Harshaw Chemical Company revealed that for satisfactory corrosion resistance the nickel deposit must be *sulfur free*. This fact lead to the development of the Perflow nickel plating process. Further research revealed that the utilization of the sulfur-free deposit as a base coating, following by a bright nickel from a compatable bath, would further improve corrosion resistance. Performance data from a number of leading car manufacturers indicate that the Harshaw Perflow-Perglow Duplex nickel plate is comparable to, and frequently better than, buffed grey nickel, and is unequalled by any bright nickel.

Exceptionally High Plating Speeds
With air agitation, high current densities can be employed, resulting in exceptionally high plating speeds.

Excellent Chrome Coverage
The Harshaw Perflow-Perglow Duplex Nickel Plate is easily chrome plated with no unusual treatment of the nickel necessary even over extended periods of time.

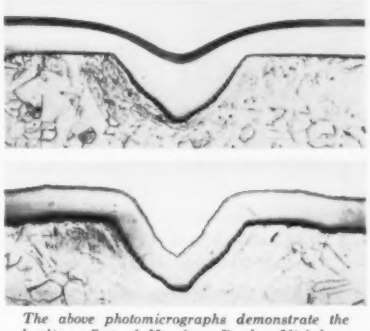
Excellent Leveling
The Perflow-Perglow Duplex Nickel has excellent leveling characteristics which aid in producing bright deposits on poorly polished steel or over dull copper plate. The leveling characteristics can be maintained without sacrificing ductility, brightness, and corrosion resistance.

Outstanding Brightness
Full, bright deposits over a wide range of operating conditions. Even intricate deeply-recessed articles have uniform brightness without shading.

High Tolerance to Impurities
The Perflow-Perglow process has a high tolerance to impurities from the standpoint of both corrosion resistance and overall quality of plate.

Excellent Adhesion
Plating nickel over nickel is no longer a problem. Current can be interrupted without affecting the adhesion. Work can be removed from the plating solution for inspection and put back in the bath without affecting adhesion.

Excellent Ductility at Full Brightness!
The ductility of the Perflow-Perglow Duplex Plate is comparable to that of a plate from a Watts nickel bath.



The above photomicrographs demonstrate the leveling effect of Harshaw Duplex Nickel as compared to that of conventional grey nickel.

Top: *Perflow-Perglow Duplex Nickel—depth of scratch 2.7 mils.*

Bottom: *Grey nickel—depth of scratch 2.7 mils.*

MANY OTHER ADVANTAGES!
simplified control . . . stable over extended periods of operation . . . controlled stress . . . uniform protective and decorative plate on both steel and zinc die castings.

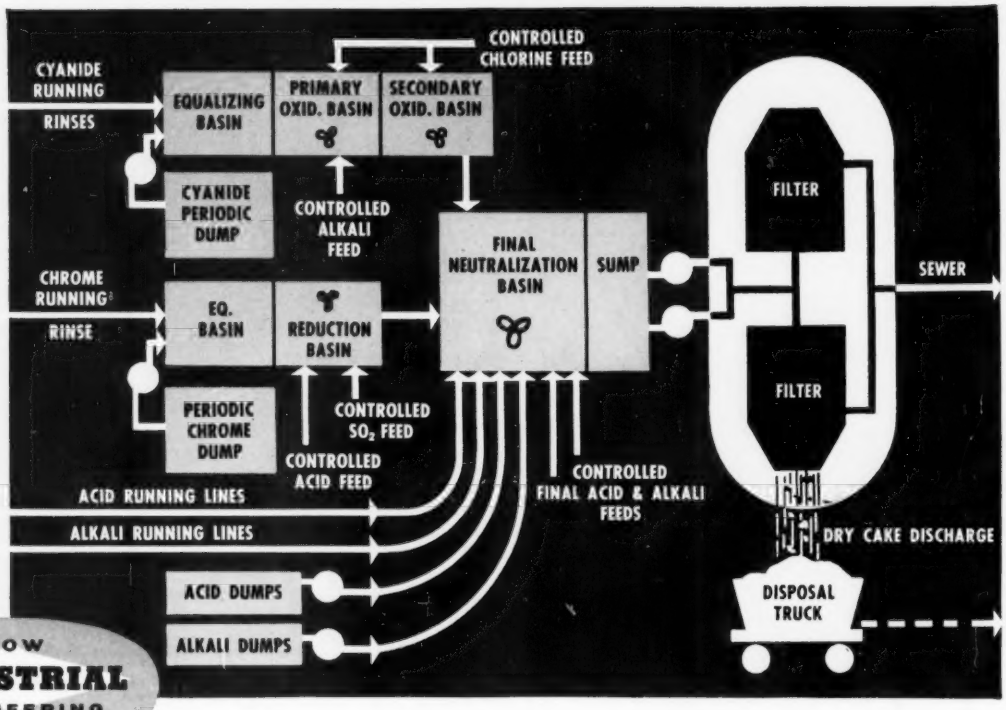
HARSHAW'S RESEARCH AND DEVELOPMENT LABORATORY SOLVED THE PROBLEM OF PLATING NICKEL ON NICKEL. THIS COUPLED WITH THE USE OF A SULFUR-FREE NICKEL PLATE HAS MADE POSSIBLE A CORROSION RESISTANT DEPOSIT THAT IS UNEQUALED.

HARSHAW

THE HARSHAW CHEMICAL COMPANY

General Offices and Research Laboratories • 1945 EAST 97th ST. • CLEVELAND 6, OHIO

Sales Branches and Warehouses: CHICAGO, CINCINNATI, CLEVELAND, DETROIT, HOUSTON, LOS ANGELES, HASTINGS-ON-HUDSON, N.Y., PHILADELPHIA, PITTSBURGH



HOW **INDUSTRIAL** ENGINEERING PAYS OFF...

EXAMPLE:

Cutting Costs on Plating Waste Disposal

PROBLEM: Large appliance plant needed an efficient centralized system for disposal of corrosive wastes from several plating lines.

SOLUTION: INDUSTRIAL *engineered system* (see diagram) provides a central basin for neutralization of all the acid, alkali, cyanide and chrome wastes delivered from rinsing operations. Only small amounts of chemicals are added to precipitate the dissolved metals for separation by filtration. The two compact INDUSTRIAL filters extract the solids and discharge a neutral non-toxic effluent to the city sewage system.

RESULTS: EQUIPMENT COSTS REDUCED BY ONE-HALF—two push-button Vertical Leaf Filters *replace* expensive clarifier mechanisms, sludge pumps and vacuum filter! . . . 90% LESS SPACE required for entire system! . . . SIMPLE INSTALLATION—no excavation or complex concrete work! . . . DRY CAKE WASTE DISPOSAL—discharged by mechanical shakers directly from filters into trucks!

INDUSTRIAL

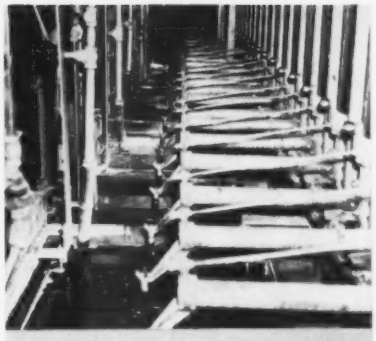
INDUSTRIAL FILTER & PUMP MFG. COMPANY
5906 Ogden Avenue, Chicago 50, Illinois

Call or write INDUSTRIAL to find out how an engineered system like this can solve your specific plating waste problems.

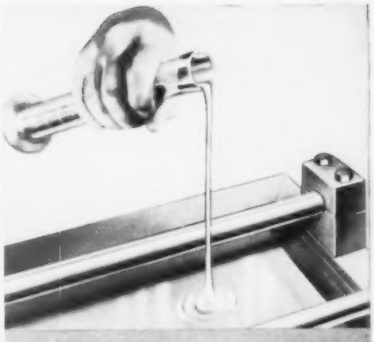
P-136

PRESSURE FILTERS ◆ ION & HEAT EXCHANGERS ◆ WASTE-TREATING EQUIPMENT

SILICON, GERMANIUM AND SELENIUM RECTIFIERS

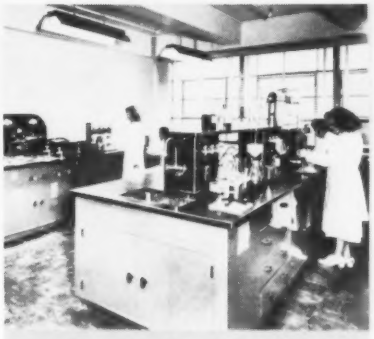


PROCESSING EQUIPMENT



CLEANERS AND CHEMICALS

CONTROLS



LAB AND FIELD SERVICE

FINISHING SUPPLIES

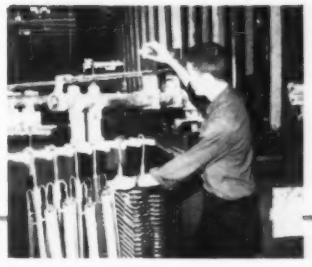
EVERYTHING FOR ANODIZING

H-VW-M is your *one source* for supplies, equipment—and the best service anywhere!

Whether you're setting up a new aluminum finishing shop, or enlarging or modifying existing facilities, you can fill *all* your needs at H-VW-M. That's because H-VW-M is the one company combining a complete engineering service with a full line of equipment and supplies for modern aluminum finishing.

Here's an idea of what you can get, anytime, from H-VW-M:

- **ELECTRICAL EQUIPMENT**—a full line of Silicon, Germanium and Selenium rectifiers, in all voltage ratings, remote and self contained models, with a wide choice of controls.
- **STILL TANK OR FULL AUTOMATIC EQUIPMENT**—whatever you need, from a single component to a complete, integrated system.
- **ALUMINUM FINISHING SUPPLIES**—new compounds, improved cleaners, and H-VW-M "*Job-Tailored*" Buffs, to give you top economy in every finishing step.
- **ENGINEERING SERVICE AND INSTALLATION**—*one responsibility*, all the way. H-VW-M engineers and technicians are specialists in anodizing equipment, with years of experience behind them.



"DIAL-A-CYCLE" MEANS *AUTOMATED ANODIZING*— set the dial, and the H-VW-M automatic conveyor does the rest! One operator can anodize or electroplate a number of different parts, each requiring its own special finish, treatment, or color. Carrier follows dial setting, lowers parts into right tank for right period, bypasses others—automatically. Save on production time, labor, capital investment.

For all information, write to Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.

H-VW-M

PLATEMANSHIP—Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

4761A

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Rx TREAT ALUMINUM RIGHT with these proven AHCO Compounds

Rx Lustralume No. 1

This outstanding new burnishing compound is a clear stable liquid readily soluble in water. It's non-toxic, non-flammable, mildly alkaline, and moderate foaming. Ideal for use in all conventional types of oblique or horizontal barrels where moderate foaming is permissible. Solutions are free rinsing and leave no undesirable films on the work. Properly cleaned surfaces emerge with a smooth brilliant lustre.

Rx Ahcal Deoxidizer

This compound is ideal for removing smut after cleaning and etching, and before painting. Its convenient powdered form make it safer than liquid acids and it gives off no dangerous or toxic fumes.

Rx Ahcal Etch Cleaner No. 1

This powdered, concentrated, alkaline material produces an attractive, uniform etch in a very short time on all types of aluminum surfaces. It's non-dusty and its solutions produces the right amount of foam. The outstanding characteristic of Ahcal is its ability to dissolve large quantities of aluminum without forming undesirable scale or sludge. As a result maintenance problems are eliminated or alleviated.

Rx Ahcoloid Cleaners

No. 189—A non-etching alkaline soak cleaner for cleaning aluminum prior to anodizing and chemical processing.

No. LC-3—An emulsifiable liquid pre-cleaner . . . ideal for removal of oil, grease, and buffing residues from aluminum. It's non-corrosive and non-toxic.

No. 59-H-5—A non-etching alkaline cleaner for use in power washers. It's low foaming and has exceptional cleaning power.

LUSTREBRITE LIQUID 35—A new type of liquid soak cleaner developed specifically for removing buffing compound residues and fingerprints. It's an aqueous solution of non-toxic, non-corrosive, organic materials. It has no flash or fire point and it's non-fuming.

Write for Bulletins to

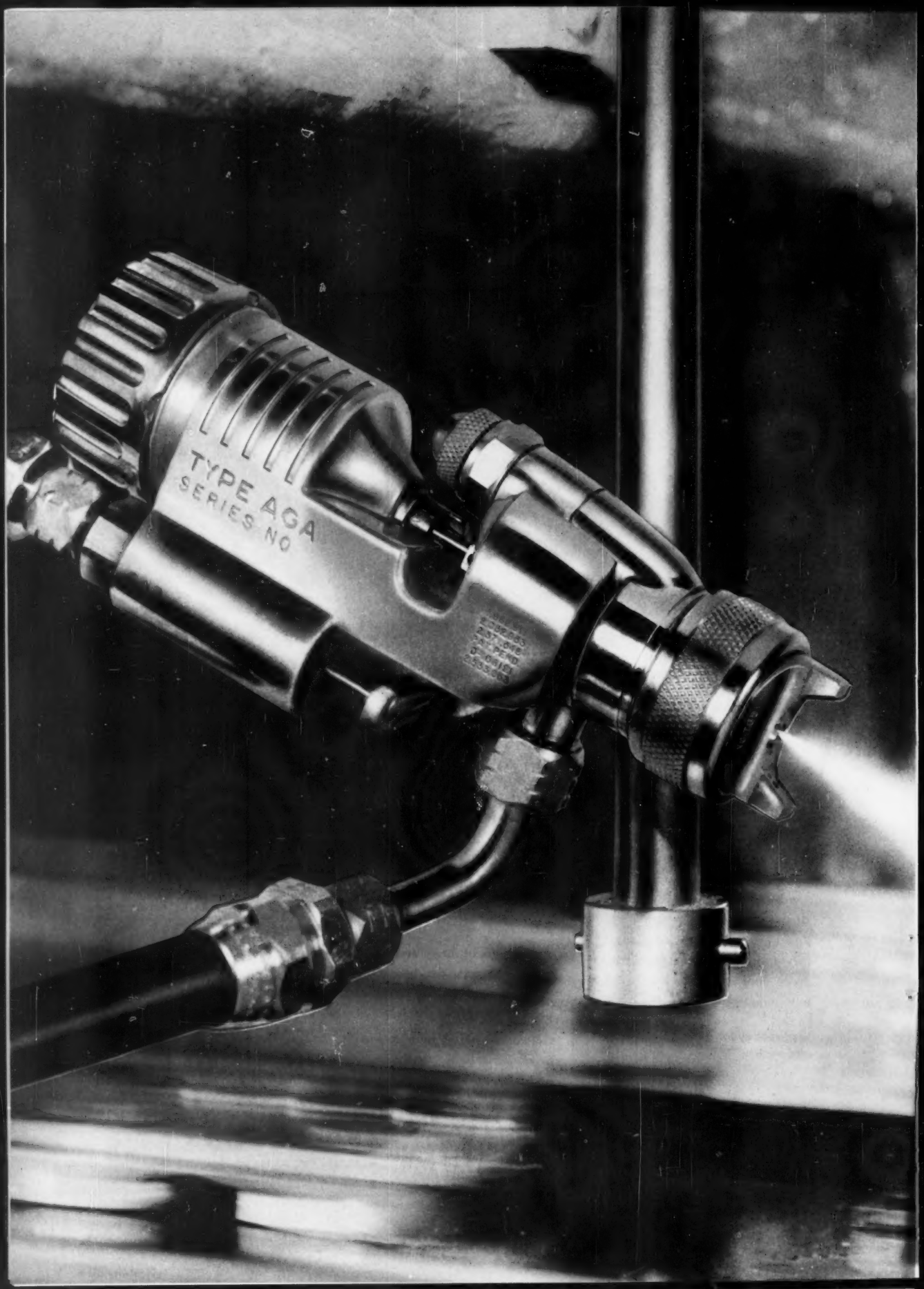
Hubbard Hall

APOTHECARIES HALL CO.

DIVISION OF

THE HUBBARD-HALL CHEMICAL CO.

WATERBURY, CONN.


TYPE AGA
SERIES NO

G-S "REPLACEMENTS" OUTPERFORM YOUR "ORIGINALS" 3 TO 1

So Much Better, You Can't Afford a Second Choice!

Compare Them All, Point-by-Point, Then Save with G-S

Your Finest Replacement Cylinder Values

All These Features at Lower Cost:

Temperatures to 220°F. — G-S Cylinders operate in "hot" processes other makes can't tolerate. For the plater who demands the most from his equipment investment.

Loads to 275 lbs. — Bigger pay-loads per cycle. Increase capacity of your plant. Greater margin of safety with G-S.

17½% More Perforations — Better, faster plating with higher currents. G-S boosts output per hour to outproduce all other makes.

100% Thru-Cycle — "Work horse" of plating. G-S goes all the way, start to finish. No transfers. Keeps your processing on "express" schedules.

All-Welded or All-Bolted. — Your option of H-T Plexiglas, G-S Polydur or Tempron. All-Welded for permanent, unit-assembly. All-Bolted for quick, low-cost, self-replacement of all parts. Toughest unit-construction. Lasts up to 3 times longer.

Heavy 2" sq. Ribs. — More back-bone for greater strength. Improved tumbling action. G-S tops them all for heavy-duty performance.

Fits All Makes. — "Custom-tailored" at "ready-made" prices. Models to fit your equipment regardless of make, size, type or age. Send specifications, or your superstructures. G-S Cylinders and accessories supplied to match. The **finest** at **lowest cost. Write for data, prices.**

G-S means Greater Savings!

Complete Equipment for your Still Plating and Barrel Plating. Performance-Proven in Years of Service at **2/3 Lower Maintenance Cost.**

G-S Replacement Cylinders
Models to fit all makes, types, sizes, ages of superstructures.

G-S "Cogged-V-Belt" Drive Conversions
Cylinder-Superstructure combinations to fit other makes of tanks.

G-S "Cogged-V-Belt" Drive Barrels
Complete with tanks. The plating barrel with **more features for better, faster plating** — higher temperatures, heavier loads, longer life, less maintenance.

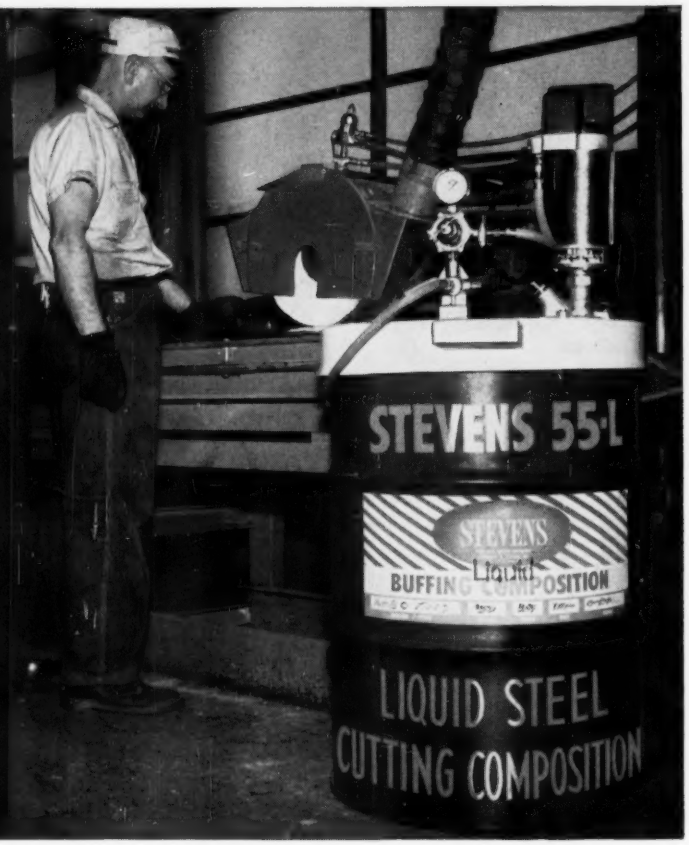
G-S Tanks, Liners, Hoods, Motor Drives, Dryers, Chute Loaders, etc.

Investigate the low-cost G-S conversion plan for your plant. Learn how it pays for itself in maintenance savings alone. Write today.

The G. S. Equipment Co.

15583 Brookpark Rd., Cleveland 35, Ohio, CLearwater 2-4770

For an excellent fast finishing job on steel



55-L is the Product

If you want to do an excellent, fast, finishing job on steel, here is the composition for you . . . Stevens 55-L. Many of our customers are using it every day, sisal-buffing steel with Stevens 55-L and producing excellent finishes.

Stevens 55-L Liquid Cutting Composition is the ultimate in liquid-type fast cut. It's a stable, non-settling, emulsion-type product. Its flash point is high, and its abrasive is a high quality, iron free, pure aluminum oxide grit.

If you have a steel buffing job to do, call in your local Stevens sales representative for the full story of 55-L and what it may be able to do for you.

STEVENS 55-L LIQUID STEEL CUTTING COMPOSITION

1. Gives an exceptionally fast cut
2. Is readily cleaned
3. Gives good color results
4. Is a high flash point, stable, emulsion-type composition
5. Is trouble-free because its abrasive is pure, iron free AL_2O_3
6. May be sprayed or brushed
7. Is stocked in 5, 30 and 55 gallon drums

frederic b. **STEVENS,** inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND DAYTON NEW HAVEN SPRINGFIELD (OHIO)

plating rejects ...with WYANDOTTE B. N.!

A message especially for Job Shop Operators:

HERE's a cleaner that does *all* your job-shop cleaning – on steel, copper, brass, bronze, zinc-base die castings – gives you an efficient, round-the-clock job; cuts rejects, too!

The product? Wyandotte B. N. – a soak cleaner and versatile electrocleaner for direct and reverse cleaning.

Think of it! You need only one cleaner to take care of all job-shop needs!

B. N. gets metal so clean all over that bright plating really sparkles! It also cleans and activates nickel before chrome.

Wyandotte B. N. offers long life and maximum detergency. It is free rinsing; has high soil tolerance and concentrated alkalinity.

Switch to Wyandotte B. N. for *your* job-shop cleaning. Contact your nearest Wyandotte representative, or mail coupon, today! *Wyandotte Chemicals Corporation, Wyandotte, Mich. Also Los Nietos, Calif. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

The Best in Chemical Products for Metal Finishing

Wyandotte Chemicals Corporation
Dept. 3045 • Wyandotte, Michigan

Yes! I would like to know more about Wyandotte B. N. for use in metal-cleaning operations.

☐ **Have representative call** ☐ **Send more complete information**

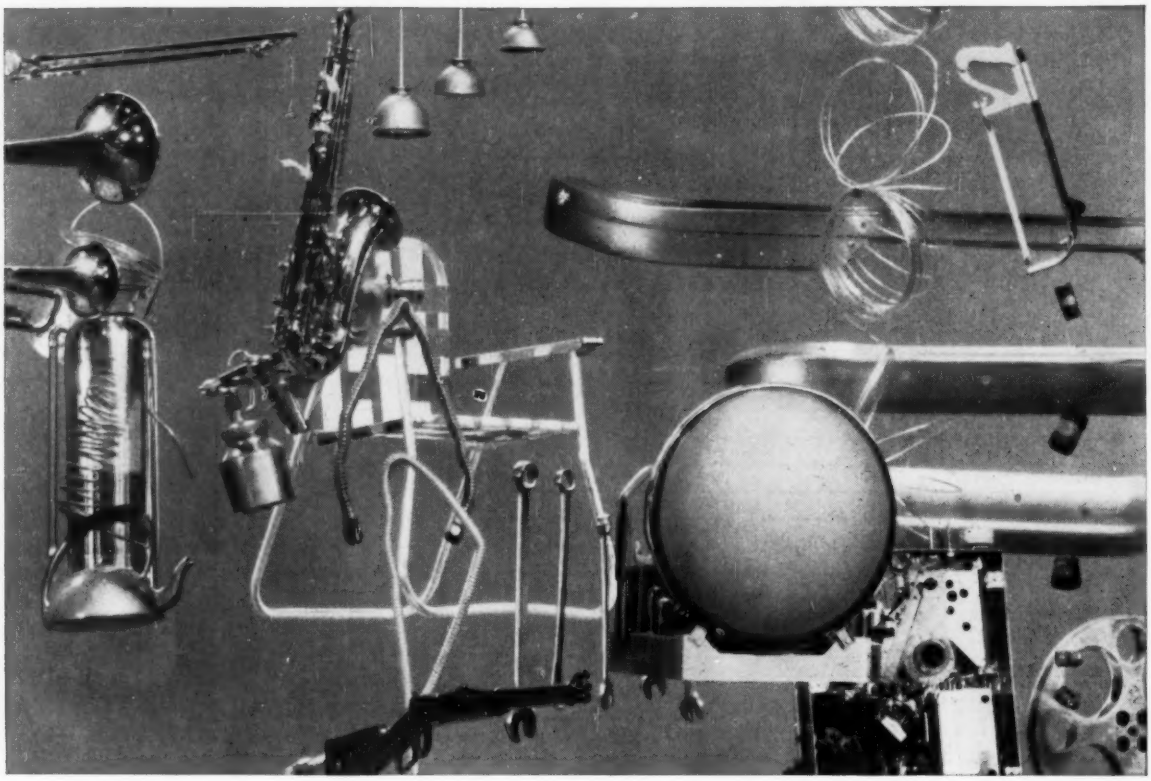
Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

Columbia-Southern Trichlor provides economical, efficient



Degreasing units are available that will clean anything from multi-ton generator stators to tiny watch gears.

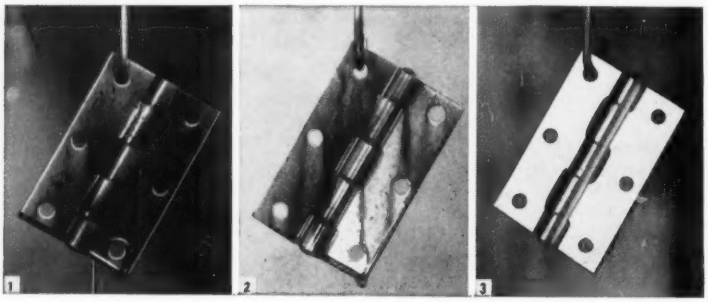
The modern stabilizer in Columbia-Southern Trichlorethylene has aided metal fabricators in eliminating a number of troublesome degreasing problems.

In the past, many plants experienced extreme difficulties, resulting in damage to work or to the degreaser unit. Frequently these difficulties could be traced to use of inadequately stabilized solvents.

Columbia-Southern Trichlor, on the other hand, is formulated to provide a stabilizer that assures built-in chemical protection against breakdown under light, heat, oxygen, acids, moisture and repeated distillations.

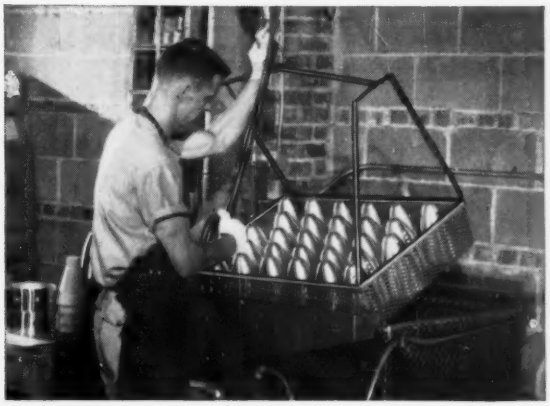
Sludge formation is kept to a minimum as this protection extends itself to the oil soils removed in degreasing.

Degreasing action starts as soon as the part is conveyed into the Trichlor vapor. The vapor condenses on the part immediately. The liquid solvent, now laden with the grease it has removed, drips into a boiling sump.

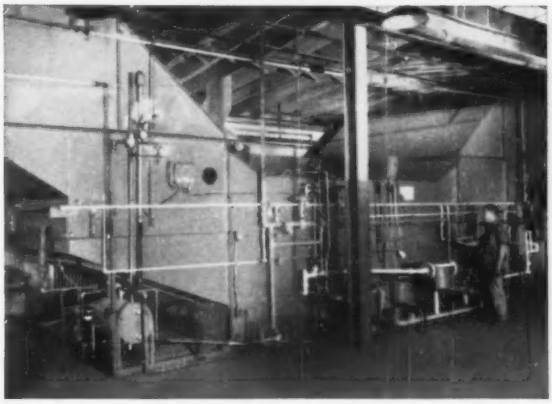


1. A hinge covered with grease, represents a typical metal part, ready for the degreasing process.
2. Vapor action has started—much of the grease has already been dissolved and carried away by the condensed solvent.
3. The process complete—the hinge leaves the vapor degreaser, clean and dry.

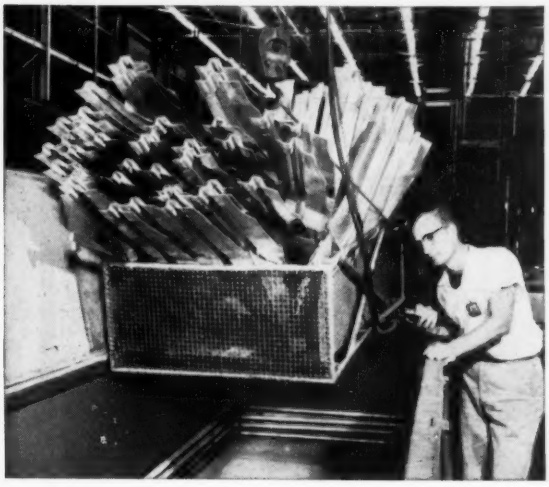
with its modern stabilizer low-cost vapor degreasing



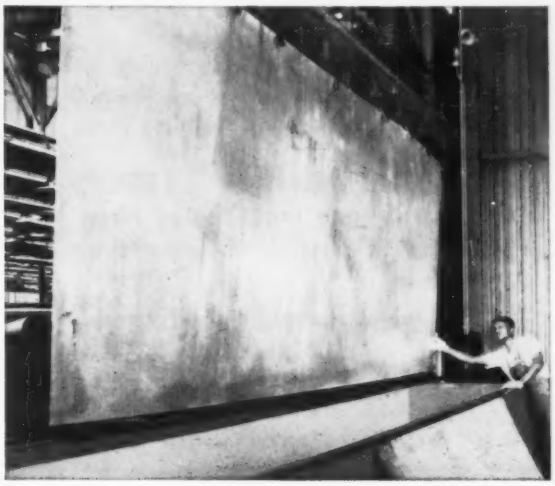
Lamp reflectors are degreased in this manually operated tank type vapor-spray unit. The unit is relatively inexpensive and it occupies very little floor space.



Fully automatic vapor—spray—vapor unit is used by this toy manufacturer for degreasing. Conveyors carry parts through all processing operations.



Vapor degreasing with Columbia-Southern Trichlor offers an extremely flexible and low-cost cleaning method for parts ranging in composition from aluminum to steel, zinc, brass, magnesium, titanium, special alloys.



Aluminum sheet and formed parts are particularly sensitive to improperly stabilized solvent. High-stability Columbia-Southern Trichlor is now specified by many large volume aluminum fabricators for efficient degreasing.

Columbia-Southern Technical Service representatives have earned a top reputation for working with customers in trouble-shooting and in establishing more effective and economical procedures for degreasing. Their services are at your disposal.

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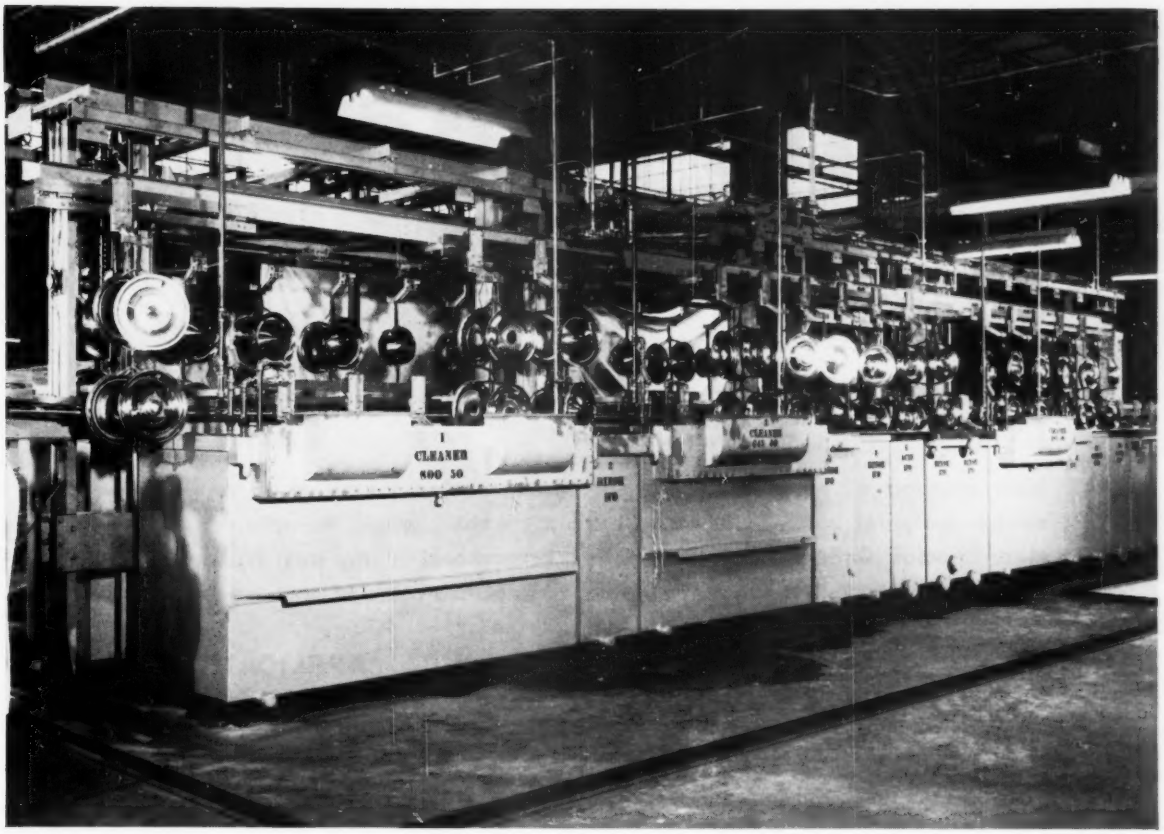
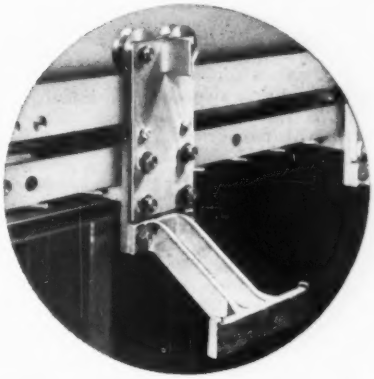


New Meaker Uniline machine provides high quality plating at high speeds

This **Meaker Uniline Plating Machine** was built to meet the rigid requirements of Namsco, Inc. in Bellwood, Illinois. It provides them with a continuous **uninterrupted high speed operation** that produces extremely high quality plating of replacement hub caps and wheel covers. This Meaker single row machine has a production capacity of **120 racks per hour** and handles the complete operation from cleaning to Nickel and Chrome plating.

Effective vertical length of rack is 34″, width in direction of travel is 15″ and tank widths are 16″.

For your plating or anodizing equipment, look to Meaker . . . the name backed by a reputation for building the best for 50 years.



Electrical contacts on carriers are positive in action due to constant load pressure and the current path from cathode rail to rack is short, minimizing voltage loss.

write for New Bulletin U-658

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New Clear Protective Coating for All Metals . . . as safe and easy to handle as Water!

New method of protection incorporates corrosion inhibitors in a water-soluble polymer base. Dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post-treatments. Used as a protective treatment alone or to enhance value of post-treatments.

Allied's new Irilac #1000 is a concentrated solution of a water-soluble polymer with built-in complex corrosion inhibiting materials. It was developed to answer the needs of the metalworking industry for a non-conversion process that will provide corrosion resistance and resistance to fingerprinting and abrasion on base metals and electrochemically or chemically finished surfaces—without changing the appearance of the metallic surface.

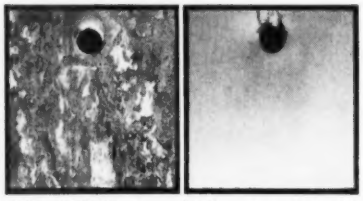
There are no hazards involved—Irilac is non-fuming, non-toxic, and requires no special fire prevention measures.

THE PROCESS

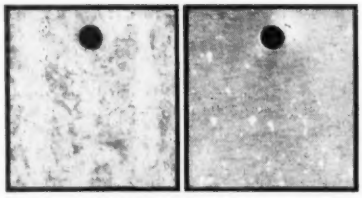
Irilac #1000 is diluted with water to provide a simple one-pass working solution. It is then applied by dip, brush or spray and forms a coating that quickly *bonds* to the metal surface without reacting with the surface.

THE PROPERTIES

The resulting coating is clear, transparent, thin yet durable. It has excellent water-resistant properties, and can be rubbed, handled and subjected to rough treatment. The surface to which Irilac has been applied is not altered—in fact, the transparent coating brings full tone to colored surfaces and clarity to iridescent surfaces. The water-thin physical characteristic of the solution means that the coating provides protection in recessed areas that are difficult, if not impossible, to protect with other methods.



STEEL PANELS: bare (left) and coated with Irilac (right) after 8-hour salt spray.



ALUMINUM PANELS: bare (left) and coated with Irilac (right) after 168-hour salt spray.

WHERE IRILAC CAN BE USED

Irilac #1000 can be applied to *any* metal—wet or dry—treated or untreated. All metals can be processed in *one* operation in the same solution. It can be applied in conjunction with any process—over Iridite, anodized, phosphated surfaces, black oxide, etc. Surfaces treated with Irilac provide a good base for paint.

APPLICATION ADVANTAGES

No other process or material available for the protection of metals offers all the application advantages found in new Irilac #1000:

1. It can be applied to *any* clean metal simply by dip, brush or spray. No special equipment is required.
2. Saves time—just apply and dry—no reaction time required.
3. No hazards involved—no exhaust or special fire protection equipment is required. Irilac is non-fuming and non-toxic.
4. Saves space. Presents no disposal problem. Low in first and final costs.

Because of its versatility and complete safety, Irilac has unlimited uses. For example, it will protect aluminum furniture, brass hardware and fixtures, steel parts of all types, zinc castings, etc. In fact, any base metal or plated surface, or those treated with electrolytic or chemical post-treatments, can be improved or enhanced with Irilac.

IRILAC #1000 MAY BE THE ANSWER TO YOUR PROTECTION PROBLEM

Our development staff will be glad to work with you to determine the significant benefits Irilac can offer you. Simply send us some parts and let us show you what Irilac can do. No obligation, of course.

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A Timely Message on Simplicity in thinking . . . a neglected ingredient?

by Ben P. Sax

Chairman of the Board, *American Buff Company*

Today's familiar electronic brains, computers, and automated production methods lead many young people to regard all worthwhile creative effort as the product only of complex and super-specialized intricate ideas. Such an attitude may foster costly neglect of simple, basic principles and their creative adaptations.

Yet "switcharoos" of basically simple ideas or simple basic principles have produced mechanical and production methods as startling in their field as many electronic successes. This point is easily illustrated by the outstanding improvements in farm building construction achieved by a self-taught engineer with a background of boyhood adaptation of familiar ideas to unfamiliar uses.

> His latest effort . . . corrugated metal panels for building frameless grain elevators, supermarts, churches, and many other large structures. By folding a piece of paper in an unusual pyramidal, double corrugation, he proved that the thin sheet stood by itself without buckling while supporting heavy weight. Use of this simple principle has cut the construction cost of a supermarket about 50%.

Let us all encourage the nation's youth to treasure and use, not neglect, simplicity . . . a vital element in every phase of life.

Sincerely,

Ben P. Sax

COMING EVENTS

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GRAND RAPIDS BRANCH
JANUARY 17, 1959
Annual Educational Session and Banquet, Pantlind Hotel, Grand Rapids, Mich.

CHICAGO BRANCH
JANUARY 31, 1959
Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

CLEVELAND BRANCH
JANUARY 31, 1959
Annual Educational Session and Dinner-Dance, Cleveland, Ohio.

NEW YORK BRANCH
FEBRUARY 7, 1959
Annual Educational Session and Banquet, Hotel Statler Hilton, New York, N. Y.

DIXIE REGIONAL GROUP
FEBRUARY 13-14, 1959
Educational Session and Banquet, Southeastern Branch, Host, Dinkler Plaza Hotel, Atlanta, Ga.

ROCKFORD BRANCH
MARCH 7, 1959
Annual Educational Session and Banquet, Faust Hotel, Rockford, Ill.

DAYTON BRANCH
MARCH 7, 1959
Annual Meeting and Dinner-Dance, Dayton, Ohio.

LOS ANGELES BRANCH
MARCH 21, 1959
Annual Educational Session and Dinner Dance, Beverly Hilton Hotel, Los Angeles, Calif.

FIFTH INDUSTRIAL FINISHING EXPOSITION
JUNE 15-19, 1959
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"CAN I AUTOMATE?"

Here ABBEY-Matic gives you the straight answers to your key questions. Don't be surprised if you learn you can — and should — be automated with ABBEY-Matic right now.

Q: "Is it practical to automate my hand-plating, dipping, or barrel plating lines which have a variety of special requirements?"

A: Yes, for the first time! If two or more operators are used, ABBEY-Matic can take over completely — including the special requirements — with unequalled efficiency and economy.

Q: "Can I automate to a limited extent, then expand later in a practical, economical manner?"

A: Yes, for the first time! ABBEY-Matic's "unitized" sections are easily added (or removed) by virtue of simple couplings to electric and hydraulic power sources.

Q: "Can I automate by degrees, expanding into my available adjacent space as desired, without complications?"

A: Yes, for the first time! ABBEY-Matic flexibility adapts to your existing space specifications — size, shape, etc.

Q: "Can I automate with my present tank-line equipment?"

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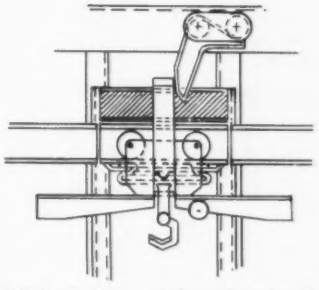

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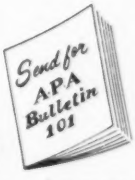

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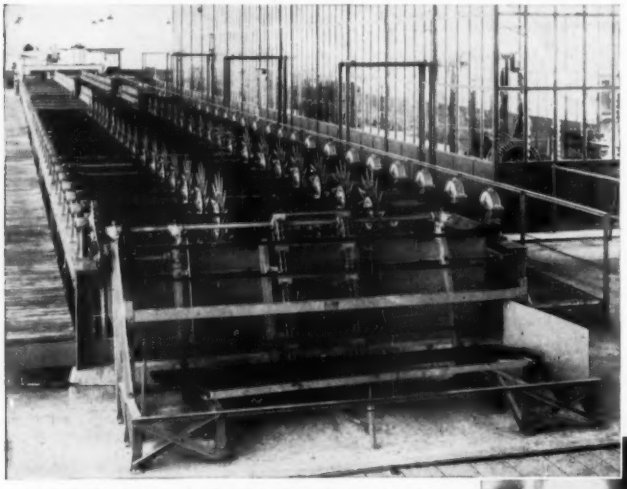

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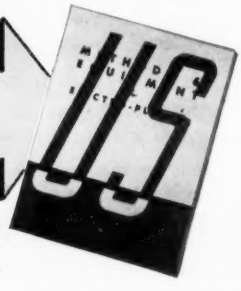

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Metal Finishing

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JANUARY, 1959 Volume 57 No. 1

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BRANCH OFFICES

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ESTABLISHED 1903 VOLUME 57 • NUMBER 1 • JANUARY, 1959

THE OUTLOOK FOR 1959

January is the month in which editors feel duty bound to prognosticate what the immediate future holds in store for their readers. This editor considers that he is especially privileged to indulge in some forecasting because of his forbearance during the previous eleven months, in which his comments were generally on matters technical rather than commercial.

Last year started off with a dull thud, and it wasn't until midyear that we started to climb out of the doldrums. Although equipment sales have been improving at a slow but steady rate, the prospects for this year do not appear so rosy that suppliers can figure on sitting back. It will take some hard selling to convince manufacturers of the desirability of investing in new equipment while the painful memories of the recent slump are still fresh in their minds. Detroit, our industry's biggest customer, has not been rushing headlong into the market, which is understandable since, until the uncertainty is cleared up as to which features on new car models will prove most popular, purchase of new plating and anodizing equipment has to be deferred.

This uncertainty, coupled with the increased substitution of anodized aluminum for chromium plate by the auto makers, has also tended toward an easier nickel market. Despite cutbacks in nickel production last year, and a strike against the largest producer, supplies are still ample to fill every conceivable demand in the foreseeable future. The price of copper has been fluctuating but the plater is more concerned with availability than with price and no problem is anticipated on this score. This probably will also hold true for the other metals in which we are interested — cadmium, zinc, tin. Since a pound of anode goes a long way and the plater has now learned, from bitter experience, that he is a stepchild when supplies are doled out in times of stress and insufficiency, ready availability should not lull him into operating with short inventories, a warning which is not appearing for the first time on this page.

Finishing chemicals of all types are in good supply and, even contrary to the common inflationary trend, price reductions have been announced recently on some items. No signs of any shortages have been appearing on the business horizon and the forecast is for continued stability of supply.

There is a well-defined trend toward automation in finishing and we believe that this year many more manually-operated plants, considered too small for full-automatic equipment, will join the parade by installing double trolleys with hydraulic hoists over lines of parallel tanks, in order to avoid the cost of rack handling. The market still belongs to the buyer and, to remain competitive, automatic polishing, automatic lacquering and painting, and automatic plating, or as close to it as we can manage, are a must since there is practically no other avenue of approach left for cost reduction.

Nathaniel Hall

Technical Developments of 1958

By Nathaniel Hall, *Technical Editor*

Cleaning

ULTRASONIC cleaning, the newest development in soil removal, was a popular subject in the trade and patent literature during the past year and, although other applications have been suggested in the field of metal finishing, all the emphasis appears to be on this operation. This is quite understandable if one considers the importance of the cleaning operation, the well-documented advantages of high frequency vibration as an assist, and the wide market for equipment which has been opened in the last two years.

Because of its novelty, the principles and basic rules to be considered have been discussed extensively. Branson described the *construction of equipment*, the *advantages and the precautions* to be taken in cleaning with ultrasonics,[1] as did Fried,[2] while Frey[3] detailed the requirements to be met by *detergents* for efficient soil removal. Basic rules were also covered by Platzman[4] and by Fishlock,[5] both authors dealing with numerous *applications in metal finishing*, in addition to cleaning.

Among the patents on *equipment* were found grants to Henry,[6] to Branson,[7] and to Kearney,[8] while Zucker disclosed an ultrasonic cleaning apparatus with a *vacuum chamber* above the liquid.[9]

Conventional alkaline cleaning was not neglected, despite the interest displayed in ultrasonics. Reports of research on the effect of oxide films on the *adhesion of electrodeposits* were presented by Linford & Feder[10] and by Linford & Venkateswarlu,[11] which will undoubtedly have a bearing on future cleaner formulation and operation. The basic considerations to be taken into account when *cleaning prior to plating* were detailed by Whitehead,[12] while Innes[13] covered cleaning, pickling, and *preparatory surface treatment*, including the factors affecting the last.

Coverage of other facets of the cleaning operation consisted of suggestions by Mohler with regard to addition of a metal salt to the cleaner for *strike cleaning*,[14] a process more popular in Europe than here; a cycle for *cleaning steel assemblies* prior to cadmium plating listed by Ananiatis;[15] and a discussion of applications for *alkaline descaling cleaners* incorporating chelating agents, by Jorczyk.[16] The Russians were responsible for a rare study, reported by Steiger,[17] in which the factors involved in *spray processing* were investigated. Experimental data were presented on cleaning, pickling, and phosphating by this method.

The inventors were quite active in the cleaning field also. An *electrocleaner for brass* consisting of caustic, metasilicate, and glucose was patented by Elliott,[18] and combination *cleaning-phosphating* compounds were disclosed by Toubes,[19] who used an acid phosphate, oxalate and a wetting agent, and by Smith,[20] who added a hydrocarbon solvent, emulsifier, and detergent to the phosphating solution.

Equipment was the subject of a number of patents. *Degreasers* were covered by two, to Pickett for a unit with a cooling jacket,[21] and to Plassmeyer for one with a settling sump.[22] A *spray washer* was claimed by Whitbeck,[23] and by Zinty,[26] a *molten salt bath* apparatus by Shoemaker & Faler,[24] and Murtland disclosed a *continuous strip electrocleaning* method for titanium and zirconium, using a caustic soda bath.[25] A continuous strip cleaning machine was also the subject of a patent granted to Bandy.[27] Other disclosures consisted of a *vibrating frame washer* for basket parts, claimed by Behnke & Westcott,[28] a tank cleaning machine with an agitator, invented by Northrup,[29] and improvements in *steam-cleaning*, comprising an electrically heated unit suggested by Wyatt & Tradewell,[30] and a gun by Thomas.[31]

Activity in the field of *abrasive blasting* appeared to follow the trend of recent years. Of two articles of interest, credit goes to Knanishu[32] for a valuable report on the effect of abrasive blasting in improving *subsequent phosphate coatings*, while Burman described the process of *wet blasting*.[33]

Twice the number of patents were issued, compared to 1957. One, most unique, was granted to Guptill[34] for a *method of propelling the abrasive* by heating a liquid to form a vapor under pressure. In the line of equipment, the disclosures included a *blasting chamber* with a collecting floor, claimed by Arnold,[35] an apparatus with a flexible line, to Hunter,[36] a tool for *sandblasting pipe interiors*, suggested by Fritze,[37] and a *sand blast nozzle*, proposed by Steffen.[38] Also, three patents were obtained by Hastrup & Hastrup; one for a *portable machine*,[39] one for blast cleaning edges of surfaces,[40] and the third for a *surface contactor* to draw off spent abrasive.[41]

Pickling

Practically all the developments in this phase of the art were to be found in the patent literature, with only three articles worthy of note, two of them on titanium and its alloys. In a study of *hydrogen absorption*, McKinsey, Stern & Perkins[42] found it best not to heat the metal after descaling since this resulted in deeper

penetration of the hydrogen. Wheatley[42a] found that hydrogen pickup was minimized during *hydride descaling* by saturating the bath with titanium dioxide and immersing parts for as short a period as possible, while Stephenson[43] suggested immersion in a solution of sulfuric acid and calcium fluoride to modify the oxide film, which was then removed in mineral acid. He and Albers also received a patent on this process.[44] Other patents in connection with the surface treatment of *titanium and other refractory metals* included the addition of a minor amount of chloride, chlorate, hypochlorite and peroxide to the standard nitric-hydrofluoric acid bath, claimed by Otto[45] for titanium and zirconium, and a pickle for the former, claimed by Simon,[46] comprising a *hot solution of caustic soda and chromate*, followed by an acid dip. As a *pretreatment for plating on titanium*, Missel suggested a dip in hydrofluoric acid containing a chromate,[47] while Topelian patented a treatment at room temperature with HCl gas,[48] also claiming it to be suitable for aluminum, zinc, lead and chromium treatment prior to plating.

In the only other article on pickling, Del Guidice[49] proposed an acid cleaner made up of nitric acid and sodium sulfate for eliminating "skin trouble" on *airframe aluminum*. Aluminum was also covered by one patent, to Newman[50] for the *rejuvenation of acid-fluoride baths* by adding sufficient free fluoride to precipitate the dissolved metal. Iron was the subject of a number of patents, *solutions for pickling* being disclosed by David & Cardwell,[51] who claimed an aqueous acid dispersion of a resin sulfonate; Chester & Irwin,[52] who suggested a sulfuric acid bath containing sodium ferrocyanide and thiosulfate; and, Hart & Kamm,[53] for an *electropickling process* using 18% hydrochloric acid with alternating current at about 1500 amp./ft.^{2}

Other patents of interest included an *acid cleaner* comprising urea, phosphoric acid, and a wetting agent, claimed by Little & Chen;[54] a *combination pickle and conversion coating bath*, for which Johns & Wojtowicz[55] used an acid solution of ferric sulfate containing oxalic acid; and production of a *bonding film for subsequent coating*, by Stephenson & Greisl,[56] which involved immersion in a solution of HCl and sodium sulfate, followed by drying and heating at high temperature.

An unusual *descalent*, patented by Conklin & Shane,[57] consisted of sodium xylene sulfonate, sodium bisulfate, tartaric acid, and a mixture of polyoxypropylene and polyoxyethylene. Other patents consisted of two fused *caustic pickling baths*, one to Henricks[58] containing elemental sulfur, which was to be followed by a quench and acid pickle for removal of residues, and the other to McHenry[58a] *for refractory metal strip* and two *pickling inhibitors*, to Plump & Carroll[59] and to Ball.[60]

Polishing

MECHANICAL:

Although a few rewarding articles turned up, most of the developments were disclosed in the patent grants, which was not unexpected. In the only research report on the subject, Jones & Zajdowski[61] found that *grease belt polishing* shows up better on mild steel than dry belt polishing, as regards the durability of subsequent nickel deposits. Other articles consisted of a discussion of *scale removal and polishing of molds* by Logozzo;[62] an outline of the considerations involved in *polishing and buffing aluminum*, by Benson;[63] the use of *abrasive belts, contact wheels and backstand idlers*, explained by Seward;[64] and a description by Hall[65] of the recently developed *loose abrasive finishing* machines. The last process was also the subject of a patent granted to Murtagh & Kinker,[66] who disclosed a *burnishing machine* using flexible rubbing elements and an abrasive-carrying liquid. Only one *belt polishing machine* was patented during the year, by DeMambro & Brown;[67] one *polishing belt*, a ribbed type claimed by Shaw & Shaw,[68] and one *buffing wheel*, which Zucker & Wilkinson impregnated with a lubricant.[69] Other rotary polishing improvements culled from the patent literature consisted of a *flexible abrasive drum*, claimed by Block,[70] *flexible abrasive wheels* disclosed by Bernstein & Block,[71] Leggett,[72] Hall,[73] and Miller & Gothier,[74] and *brushes* devised by Nelson[75] and by Peterson.[76]

Buffing compounds were covered by one article, in which Candee[77] described the advantages and application of *liquid types*, and by three patents, one to Doughty & Candee[78] on the same subject, and the others to Marsh & Betcher[79] and to Riegler & Dybalski,[80] both for anti-slaking *lime buffing compounds*.

Activity in the field of *barrel finishing* appeared quite limited, the literature turning up only two articles, by Biebel[81] on barrel finishing *variables and their control;* and by Glasrud,[82] who used the question and answer form to cover the *possibilities for barrel finishing*. Two patents were issued, one to Lupo on a tumbling barrel with a *separating screen*,[83] and the other to Bergman on a *wet barrel*.[84]

CHEMICAL AND ELECTROLYTIC:

Chemical polishing interest seems to be decreasing year by year, and the past year was no exception. Only one article turned up, a survey of the field by Spencer;[85] and three improvements were patented, Mathre & Sowards disclosing a *phosphoric acid bath* containing monoperphosphoric acid;[86] Neunzig, Baumann & Helling[87] claiming a *bath for aluminum* consisting of nitric and hydrofluoric acid solutions to which a small amount of lead salt is added; and, finally, a disclosure by Helling, Neunzig & Nies[88] suggesting *recrystallization of aluminum alloys* by heat treating to better adapt them for polishing.

Electropolishing, in contrast to the lack of new information on chemical polishing, interested a reasonable number of scientists, resulting in the appearance of four articles and numerous patents. Jumer, in a series of papers discussed the *what, how and why of electropolishing*, and listed formulas for practically all commercially-employed metals, including the less-common ones;[89] while Tomkins[90] covered theory, control, secondary effects, applications and costs. More restricted articles were by Lorking, on *methods for copper, brass and aluminum*,[91] and by Nugent, on *aluminum reflectors*.[92]

The patent pages disclosed new solutions: sulfuric and hydrochloric acid baths for *nickel*[93] and acetic and hydrochloric acid for *zirconium*,[94] claimed by Saubestre & Bowerman; phosphoric and sulfuric or hydrochloric acid plus alginic acid for *stainless and carbon*

steel in addition to *nickel and cobalt alloys*, obtained by Robinson;[95] and a citric acid bath for *uranium*, suggested by Flint.[96] The patent literature also turned up three patents on equipment, one to Hackenburg[97] for a *barrel process*, one to Jumer for an apparatus claimed suitable for *interior surfaces of vessels*,[98] and the third to Flemming & Damgaard[99] for electropolishing *limited surface portions* of articles.

Anodizing Aluminum

Preoccupation with electrolytic oxide films on aluminum was about average and definitely has not kept pace with the increased adoption of the finish as a substitute for plating. However, some interesting developments came to light, among them theoretical papers by Plumb on the results of a study of *barrier layer production*,[100] and by Lewis & Plumb[101] on the direction of ionic movement in *anodic oxide growth*. Plumb also proposed a new technique for *studying the oxide surfaces*.[102]

Along more immediately practical lines, Hafer reviewed *principles and practice*,[103] Kape discussed in a general way the different *processes and metal preparation*,[104] and Wiesner & Meers described the production of *hard, thick films* on aircraft parts, especially the methods of controlling thickness.[105] The advantages of *titanium-tipped anodizing racks* were detailed in a short article.[106]

Colored finishes were treated in three articles worthy of note. Henley[107] described various commercial methods for production of *multicolor effects*, including the photosensitive oxide films; Spooner tested the *lightfastness of available dyes* for anodized aluminum, using both accelerated tests and outdoor exposure;[108] and Steiger reported on Russian practice for *gold-dyed aluminum* watch cases.[109] Inventions were rather meager, consisting of a series of *anodizing solutions* containing organic materials, proposed by Ernst;[110] a method of anodizing *aluminum-coated iron*, for which LaTour & Perry employed a hot electrolyte at high current densities;[111] and a continuous, rapid method for *aluminum strip*, claimed by Cybriwsky & Mostovych.[112]

Metallic Coatings

PREPLATING METHODS:

Although novel methods of preparing basis metals for subsequent electrodeposits have been appearing with regularity, and have been reported in these yearly surveys, the attention paid at present to depositing over the less common metals employed in missiles and aircraft seems to warrant presentation of this subject as a separate section, rather than to distribute the contributions throughout the report. As would be expected, *plating on aluminum* occupied the attention of a number of researchers. Atkinson produced *adherent deposits of copper* from an acid solution by employing a bath of oxalate, pyrophosphate, ammonium ion, and triethylamine as a substitute for the usual zincate or other pretreatment,[113] while Withers and Ritt applied a *thin nickel deposit* followed by heat treatment, prior to subsequent plating.[114] Two patents were granted on *direct chromium plating*, one to Topelian[115] who immersed the aluminum in a solution of chromic acid, HCl, and chromic chloride prior to plating, and the other to MacLean,[116] who employed a plating bath of the chromic acid-sulfate type at *very low temperature and high current densities*.

Other patents in connection with chromium plating, consisted of one to Topelian for plating directly on *zinc and lead* involving a predip in a solution of chromic, phosphoric and hydrochloric acids,[117] and the other to Patrick, who *activated nickel surfaces* by cathodic treatment in a dilute solution of chromic acid and sulfate at very low current density.[118]

Pretreatment methods were also covered in other articles and patents. Missel described the production of *thermal shock-resistant nickel deposits* on copper[119] and with Powell, patented a method for *plating on titanium*.[119a] Galli[120] covered bright nickel plating on *leaded brass and bronze*, and Schaer, Safranek & Faust[121] investigated the production of adherent *antimony deposits on iron*, using phosphoric and other acid solutions for pretreatment. Among the patent disclosures, Beach[122] deposited *bismuth on nickel plate* by alternate anodic and cathodic treatment in an acid chloride bath, followed by diffusion heating to alloy the bismuth with the underlying nickel; Gray nickel plated *uranium* after dipping in molten ferric chloride[123] and, with Schweikher,[123a] claimed nitric, followed by HCl; and Schaer obtained adherent *nickel-chromium deposits on molybdenum* by alternating the deposits and then heating at high temperature to form a diffusion alloy.[124] Huddle & Flint prepared *refractory metals* by steel shot blasting, followed by copper coating, prior to plating,[124a] and Foley & Raymond[124b] impregnated *powder compacts* with an oil before plating.

NICKEL:

Certainly warranted by its predominance, this metal accounted for more articles and inventions than any of the other coatings. Saubestre, in the first of a series of articles, discussed *alkaline solutions* in an outstanding presentation of why nickel will not deposit from cyanide baths, although it will from others.[125] In two further articles he took up the *chemistry of Watts baths* in terms of each constituent,[126] and *brighteners* of the first and second class.[127] Another series of articles, by Fishlock,[128] surveyed the whole field of *bright nickel plating* — solutions, present status, equipment, control and practice. A subject of deep interest, *impurities* in bright baths, was investigated by Rousselot & Rousselot[129] to determine their effect on the *covering power* of a subsequent chromium solution. An assortment of *brighteners* was culled from the patent literature, disclosed by Fischer,[130] Gundel, Strauss & Haas,[131] and Kirstahler, Strauss & Willmund,[132] for many other metals besides nickel. Other patentees were Nobel & Ostrow,[133] Foulke & Kardos,[134] Ford & Shenk,[135] Kardos,[136] and Becking & Brown.[137]

In a study of *stress in the deposits*, Hoar & Arrowsmith[138] interpreted the results of their experiments by means of vacant-site and dislocation theories. This phase was also covered in another article, on production of stress-free deposits from the *sulfamate bath*,[139] and in a patent granted to Carr, who added orthoformylbenzenesulfonate to obtain a *compressively stressed deposit*.[140] Other articles included two on corrosion, in one of which Sample detailed developments relating to *corrosion behavior* and protective value of

decorative nickel.[141] In the other, Stephenson reported on tests which showed that the use of *nickel against silver* on bolts and nuts to prevent seizure, when high-chromium content steels are employed at high temperature, results in better release characteristics than silver-silver combinations.[142] Also, Castell pointed out the value of *specifications* in decorative nickel plating.[143]

The only articles on *barrel nickel plating* were contributed by Maling, on *drag-out* measurement and recovery,[144] and by Bunce, who described various solutions (a literature review) and the results of an investigation on *speed and quality*,[145] confirming that larger holes in the cylinder results in better deposition. Other developments included a description, with excellent photomicrographs, of the characteristic appearance of *oil pores* in nickel deposits, by Sommer;[146] details on a radically new method of producing *patterns* by nickel plating over films left by silicated cleaners, presented by Frey;[147] and a patent issued to Wesley & Knapp[148] for a chloride-type *black nickel* solution.

Electroless nickel was represented by only one article, in which Girard presented the properties, advantages, and production of these coatings.[149] However, eight improvements were disclosed by the inventors, Talmey predominating. Bolin added glue or gelatin to the standard bath and then heat treated the deposit to increase *ductility and corrosion resistance*.[150] Other additions were claimed by Gutzeit, Talmey & Lee,[151] by Metheny & Talmey,[152] by Gutzeit, Talmey & Lee,[153] and by Talmey & Gutzeit.[154] Continuous *processing and regeneration* of the bath was the subject of another patent granted to Talmey & Metheny,[155] and the former is also credited with one on *printed circuit production* employing electroless nickel.[156]

CHROMIUM:

Aside from hard chrome plating, there is not much to report. *Corrosion studies* by Brown, Weinberg & Clauss[157] showed that 0.05-0.08 mil of bright chromium from a solution of ratio 150:1 to 200:1, at 130°F., over nickel, gives the best results in *outdoor exposure*. *Barrel plating* was described by Mahlstedt,[158] a *lead anode* was patented by Cibulskis, Shacat & Mahlstedt,[159] and other patents consisted of a *fluorine catalyst*, claimed by Smith,[160] a solution containing sulfate and fluoride, disclosed by Raymond for *porous chromium deposits*,[161] and an *electroless* process for which Eisenberg & Raleigh employed a chromic salt, hypophosphite, oxalic acid and salts of same.[162]

Research by Cohen[163] indicated that shot-peening prior to *plating high strength steels* is very effective in overcoming the harmful effect of the plating, while Millage & Hague[164] found that the fluorinated surfactant which is used to keep down spray is a cause of *pitting in thick deposits*, although having no harmful effect on decorative deposits. In this interesting paper, the authors also described the "low catalyst" type of pitting and the extension of basis metal pores into the deposit. A new *spray depressant* of the fluorcarbon type was also the subject of a patent granted to Brown.[165]

In other articles, Mohler suggested suitable *thicknesses* of chromium for different applications,[166] Steiger[167] described a Russian *hard chromium bath* consisting of chromic acid and ammonium fluoride which operates at room temperature and requires low current densities, and deBuyer[168] showed how chromium could be applied *over sprayed iron and copper* to salvage worn or damaged machine parts. Also, Hirasawa described a large *Japanese* installation employing a 22,500 gallon chromium tank,[169] and Wharrad detailed the use of this metal in *engineering*.[170]

COPPER:

Practically every disclosure came from the patent grants, only two articles turning up, one by Peters[171] describing the *acid sulfate bath* containing phenolsulfonic acid, and the other by Okubo & Nozaki,[172] whose studies indicated that the *flecking produced by cyclic stressing copper*, deposited from the acid sulfate bath, occurs only when grains develop in sufficient size to reach the surface. The patents concerning acid copper plating consisted of an *insoluble copper anode* for use in plating printing rolls, and containing 3% each of tin and antimony, claimed by Mundell,[173] and three *addition agents*, to Condon[174] for a yeast protein autolysate, to Strauss, Kirstahler & Willmund for an organic complex,[175] and to Harrover for the organic reaction product of an alkylolamine.[176]

Brighteners for cyanide baths have long intrigued researchers, and a goodly assortment of new ones appeared during the year. Wernlund claimed various *metallic types*,[177,178] Manquen restricted his claim to tellurium,[179] and Foulke & Kardos suggested a titanium coordination compound.[180] Mixtures of *metallics and organics* were claimed by France,[181] Martin & Parker,[182] and Boelter,[183] but only one inventor, Moy,[184] found satisfactory results with a *non-metallic brightener*, his grant calling for a thio-substituted heterocyclic ring compound.

CADMIUM — ZINC — TIN:

There was no rush to the printed page concerning these metals, although some of the presentations were quite valuable. Of important implication to all cadmium platers was the discovery by Johnson, Schneider & Troiano,[185] that *hydrogen embrittlement* could be eliminated by applying a thin deposit, which will allow the hydrogen to outgas on *baking* for only one hour at 300°F., then applying additional deposit, as required. In other reports, Kennedy[186] studied the effect of cadmium plating on the *tensile strength* and *stress-rupture properties* of high strength steel at elevated temperature, and Cohen reported on the embrittlement of these steels,[187] concluding that cadmium should not be used for plating parts subjected to high temperature. Patents were issued to Winters[188] and to Foulke & Kardos[189] for *addition agents*, to Greene & Holzwarth for *immersion deposits on aluminum* from a solution of cadmium chloride and HCl,[190] and to Vlannes, Strauss & Brown[191] for a *cyanide-free bath* consisting of an alkylmonoamino-monocarboxylic acid.

The meager literature on *zinc coating* consisted of an article on the preparation and control of the *cyanide baths*, by Foley,[192] and the results of an investigation by Wolff[193] which showed that the exposure time of *zinc-plated steel* to red rusting was about doubled by *chromating* the surface. Two patents were granted, one to Logan on an *acid bath* containing zinc sulfate, fluosilicate, and calcium or strontium,[194] and the other to

Jackson for a cyanide zinc *brightener*.[195]

Only one article appeared on *tin*, a study of the stannous fluoride bath, by Talaty & Kappana, which indicated deposition from complex ions.[196] A flavonol compound as a *brightener* for the acid bath was patented by Frick et al.[197] Tinnon & Simmons received one on a combination *cleaning and immersion tinning* bath[198] containing a tin salt, alkalies, a chelating agent, and a wetter, Johnston[199] claimed the elimination of striation and anode pattern in *continuous strip plating*, and Manko produced a *dull fused coating* by applying a solution of an oxidizing agent prior to flowing and quenching.[200]

ALLOYS:

This was a banner year for alloy plating although, surprisingly, only one article appeared on *brass*, the most commonly deposited alloy, and only a single item on *bronze*, a patent issued to Safranek & Faust[201] on production of the *15% tin alloy* from cyanide baths. The single article was by Roehl, on *brass plating steel strip* at high speed from the high temperature, high copper:zinc ratio cyanide bath.[202] The most novel developments might be considered the patents obtained by Eisenberg and Raleigh on *electroless alloys* obtained from oxalate, citrate, and tartrate baths, using hypophosphite as the reducer. These included alloys of iron with nickel, cobalt and chromium[203-4] and alloys of vanadium with all these metals.[205]

Electrodeposited *chromium alloys* were treated in two patents, one to Safranek[206] for a bright alloy with iron, nickel or cobalt, using a *trivalent bath with organic brighteners*, and the other to Quaely[207] for a black, *chromium-vanadium alloy* deposit, produced at high current densities and low temperature from a chromic acid solution containing vanadium salt and a carboxylic acid. Other hard metal alloy deposits were covered in both articles and patents. Lowenheim, Sellers & Carlin[208] found *tin-nickel* deposits comparable in protective value to nickel-chromium, not as good in marine but superior in industrial atmospheres. They also found the types of corrosion to be different. The optimum conditions for depositing *nickel-iron* and *nickel-cobalt* alloys from pyrophosphate baths were determined by Sree & Rama Char.[209] Case & Krohn obtained bright and adherent *iron-molybdenum* alloys from an alkaline molybdate bath containing ferric chloride and pyrophosphate,[210] while Ernst & Holt[211] studying the *cathode reactions* and measuring *cathode potentials*, explained why only certain metals will alloy with molybdenum. Further alloy patents went to Safranek[212] for a leveling, ductile *iron-zinc* deposit, to Faust & Safranek for an acid *nickel-iron-zinc* bath,[213] and to Scheer & York for a *cobalt-nickel* alloy from a chloride bath containing a minute amount of thiocyanate.[214]

Concerning soft metal alloy deposits, Scott outlined those employed for *aircraft engines*;[215] Garrett described the control of the 7% *tin-lead* alloy by comparing weight of deposit to that on a lead coulometer, employing a novel cathode design; while patents were granted to Lowenheim & Forman[217] on an *antimony-tin* bath, and to Waterman & Gripp[218] for *indium-lead* alloys from acid polyaminotetraacetate solutions. *Gold alloys* were the subject of two papers, Parker discussing recent developments and applications,[219] and Harr & Cafferty detailing the formula and operating conditions for a 22 Kt *gold-silver* alloy.[220]

OTHER METALS:

In addition to the two gold alloy papers mentioned above McNally[221] patented the production of *immersion gold deposits* on silver using an acid gold chloride solution. *Platinum* was the subject of a valuable study, in which *soluble anodes* were employed by Atkinson,[222] using a highly acid solution of chloroplatinic acid. Ductile, *heavy deposits* were obtained at HCl concentrations of 225-290 g./l. Two articles concerned themselves with *silver*, Greenspan describing modern practice,[223] and Benham[224] investigating *high purity anodes*. The latter found that such anodes, when annealed and with small grain size, give good results over a wider range of conditions than other anodes.

Base metals were claimed in four patents; Breining, Nixon & Vincent used a sulfonated catechol bath for *antimony* deposits,[225] Eisenberg[226] invented an *electroless iron* process employing a ferrous salt with hypophosphite as the usual reducer, an *immersion acid bath for lead deposits* on iron was disclosed by Wagner, Golar & Kusa,[227] and Ziegler & Lehmkuhl[228] proposed an organic complex bath for depositing *aluminum*.

Electroforming — Metalizing — Vapor Coating

Practical articles on *electroforming* were contributed by Pasley, who covered in excellent detail the preparation and copper plating of *wax and plastic models* to form *casting molds*,[229] and by Stokes, who described the *repair of metal molds* by nickel deposition.[230] The use of *plating cells* for short production runs of *complex contours* was suggested by Saubestre,[231] while patents were obtained by Molloy on electroforming *wave guides*,[232] and by Miller on a *mold* made of thin copper deposit backed up with an 88/12 tin bronze plate.[233]

Metalizing non-conductors was treated in three patents, to Millard[234] for a *spray silvering* solution employing b-hydroxyethyl hydrazine as a reducer; to Mendes,[235] who plated on plastic after forming a *conducting film* of antimony, bismuth, and arsenic by vacuum deposition; and to Loward & Tyler,[236] on the production of *metal inlays* on plastics.

Printed circuits received some attention also. Production by the *photosensitive resist* method was described by Van Deusen,[237] and the different types of *laminates and deposits* by Rider.[238] Patents were obtained by Robinson, for a *method of plating*;[239] by Berlinghof for a *conducting silver ink*;[240] and by Lyman & Yanosik for printed circuits produced by use of *light-sensitive emulsions* of gelatin and silver halide.[241]

Vacuum metalizing procedures, characteristics, and applications were detailed in articles by Matilo,[242] Self & Scharnberg,[243] and Remond & Johnson,[244] while *racking and masking techniques* were described by Seiter.[245] Patents consisted of *silver mirror* production, claimed by Westerveld, Van Tyen & Haes,[246] the use of a *carbon core as a filament*, disclosed by Alexander, Baxter & Boston,[247] and a method of *coating quartz crystals*, invented by Gerber & Schafer.[248]

There was only one article on *gas plating* during the year, in which Owen[249] described in detail the proce-

dure and equipment for depositing *nickel* from its carbonyl. However, patents were numerous, as usual, with *chromium coatings* predominating. Samuel accounted for four of these, all on iron and steel,[250] while others were obtained by Galmiche[251] who first deposited a layer of nickel, cobalt or manganese, and by Seelig & Wachtell for *chromium on molybdenum, tungsten, and their alloys*.[252] In other patents, Bulloff[253] deposited aluminum from an organo-aluminum compound. Drummond used *scrap as a starting material* for depositing light metals,[254] and Heibel & Schell produced *copper coatings* without codeposited oxides on ceramic.[255]

Interesting developments in gas plating also included the use of *nitrous oxide as a brightener* along with the metal vapor, claimed by Novak & Hamer;[256] deposition under *elevated pressure*, disclosed by Schladitz;[257] production of *integral metal shapes* suggested by Marvin;[258] and a method of *forming printed circuits* by gas plating, due to Toulmin.[259]

Conversion Films — Corrosion Prevention

In the broad area of conversion coatings, *chromate and phosphate* processes predominated as usual and, as in the past, the former received more attention both in the technical and patent literature. Tinsley[260] compiled a comprehensive *patent literature survey*. Drysdale detailed the selection and use of these phosphate processes as *pretreatments* for subsequent organic finishing.[261] Van der Bruggen[262] limited himself to *phosphating iron and steel*, and Wagner reported on his investigation of the effect of the *chromic-phosphoric rinse* after phosphating on water-displacing preservatives.[263]

Among the very numerous patents on solutions, Heinzelman & Williamson[264] claimed addition of a *zirconium compound*, Miller[265] added a *pyrophosphate*, Rossteutscher suggested a *low pH bath* for iron and steel.[266] Maurer a bath for *hot galvanize coatings*,[267] and Blaser the addition of an *amide*,[268] while Stapleton claimed *nitrate plus* a minute amount of *molybdate* as an accelerator.[269] Other solution improvements were granted to Otto & Heller[270] for a process aiding in *drawing*, a solution of *phosphoric acid and a tannin* to Shreir,[271] addition of formamides to increase the solubility of metal *accelerators*, patented by Kronstein,[272] who also disclosed an unsaturated alcohol as accelerator,[273] acid *pyrophosphate baths* to Parson & Truhlar[274] and, finally, one to inhibit *wet storage stains* on galvanized surfaces, claimed by Prust.[275]

According to Cerma,[276] the efficiency of a room temperature bath could be maintained by *replenishing* with a solution of zinc phosphate, nitrate, and nitrite. Three patents were also issued for *post-treatments*: to Hyams, who applied *steam* to the wet phosphate film to complete coating action;[277] to Tuttle, Vittands & Walsh,[278] who employed a solution of a *stannous salt* and an aliphatic polyhydroxy acid; and to Butler[279] for the application of a metal salt of a *phosphorodithioic acid*, either with or without prior phosphating.

There were only two articles on *chromate* films. Stella reporting on a study of the *chemical and physical factors* that affect the coatings on zinc,[280] and Fishlock describing the *solutions and film properties* for different metals.[281] Noteworthy among the patents was one to Schuster & Baldi involving *activation, etching and application* of a partly reduced chromic acid, which was allowed to dry on.[282] Solutions for *aluminum* were claimed by Carroll & Newhard[283] who disclosed *fluoride and chromate*, Stricklen[284] for *fluoborate and chromate*, Newell & Walen[285] for sulfamate, fluoride, nitrate, and chromate, Spruance & Newhard for fluoride and chromate plus *zirconium*, *titanium*, and tetravalent *tin*,[286] and Jeremias for fluoborate, chromate and *dichromate*,[287] all the foregoing for acid baths.

For *magnesium*, Schjelderup claimed an acid solution of chromate and an excess of barium nitrate,[288] DeLong claimed chromate and sulfate,[289] and Kinder & Stricklen suggested chromate, nitrate, and chloride.[290] *Silver* was covered by one patent, to Melse & Baeyens,[291] while *zinc* was the subject of patents to Stareck[292] for a solution of chromate, sulfate, nitrate, and acetate, and to Hartman[293] for a solution of chromate, borate, and fluosilicate, specific for *mill-galvanized sheets*.

Combinations of *chromic and phosphoric* were claimed for some applications, a hot solution of both acids for use on *stainless steel* was suggested by Karchner.[294] Curtin patented a process which involved application of a chromate and *hypophosphite*, followed by heating.[295] Jeremias covered a solution of chromic and phosphoric acid plus acetate and fluoborate for *aluminum*,[296] and Rausch employed these two acids plus oxalic.[297] *Oxalate* was the basis of three additional methods, Rausch & Gonnert claiming one for *stainless steel*.[298] Jenkins & Freeman disclosing a bath of oxalate, chlorate, and an organic nitro compound,[299] and de Cerma[300] suggesting a solution of oxalic acid and sodium nitrite for *iron and steel*.

A number of other processes were patented, which do not fit any of the above categories. McGlasson & Radd[301] claimed an *electrolytic method* which formed a protective layer of ferric hydroxide, a *sulfide type coating* for iron was disclosed by Newton & Sienczyk,[302] and *ferrate* films were suggested by Harrison[303] and by Castle.[304] Other *miscellaneous processes* included a solution of sulfamic acid, citric acid, and sodium bifluoride, claimed by Marosi,[305] production of *oxide films on aluminum* by immersion in alkaline hydrogen peroxide, granted to Young,[306] a hot acid fluoride solution which Otto claimed suitable for *zirconium*,[307] and an anodic process for *tin*, for which Fredrickson employed alkaline hydroxide and chromate.[308]

Waste Treatment

Nothing world-shaking in importance developed in this field during the past year, although some of the reports were of definite value, especially a description by Byrne, Turnley & Williams[309] of a *combination chlorination and electrolytic oxidation* method to reduce cyanide below 5 ppm by saturating the waste solution with sodium chloride and electrolyzing with graphite anodes. In addition, Serota surveyed the whole subject of *cyanide treatment*, including chlorination, ozone, ion-exchange, and electrolysis.[310] Various aspects of *waste disposal* were covered in the technical literature. Foulke[311] outlined the *trends*, Milne pointed out the *conservation approach* in industrial waste con-

trol,[312] and Keating evaluated the factors which determine whether *recovery or disposal* is in order.[313] Variations in the *design* of plating waste treatment systems were detailed by Dvorin,[314] and Wild[315] described the different *types of treatment*, plant layout, and construction for effluent problems.

Actual *plant installations* were treated by a number of authors. Whalen,[316] Gasper[317] and Garrett, Garland & Sawyer[318] covered I.B.M., Maytag, and T.W.A. units, respectively, while Rothstein disclosed his *service experience* in plating department chemical waste treatment.[319]

Pickling wastes was the subject of four articles and two patents. Barnhart[320] described the *Ruthner* process in which spent pickle liquor is treated with HCl gas to form ferrous chloride and sulfuric acid, the former being separated and roasted to recover iron oxide and the HCl, while the sulfuric acid bath is returned to process. Lang detailed the method of *cooling* to crystallize out ferrous sulfate, as suitable for small, *batch pickling* operations.[321] Allen *regenerated* the wastes by adding copper and heating in the presence of oxygen,[322] and Jappelt, Doerges & Schade treated the waste *cyclically* to produce ammonium sulfate and ferrous hydroxide.[323] Dissolved metal was found removable from *magnesium sheet pickles* by ion exchange, according to Anderson[324] while, for *lime neutralization* of the waste liquor, Faust & Orford found that sludge volume is reduced by *seeding the solution* with gypsum or return sludge.[325]

Testing and Control

Technical men appeared to be more preoccupied with deposit thickness determination and property tests than with solution analyses, if we are to judge from the year's literature. Mohler discussed the use of a nickel plating solution as an *analytical standard*,[326] and also described proper methods of *sampling* a solution.[327] EDTA reagent was used by Salka for titrating *iron in chromium solutions*,[328] and by Baker,[329] who found that the method for *zinc and cadmium* compared very favorably with electrolytic determination and with ferrocyanide titration. Szmidt, Zak & Kwiatkowski[330] developed a rapid, quantitative procedure for *brighteners, levelers, and antipit* in nickel solutions, employing a polarigraph while, for the minute amounts of materials found in wastes, Ohlweiler & Meditsch detailed an *absorptiometric* method for *cyanide*,[331] and Stevens & Lancy[332] simple, practical procedures for *zinc, cadmium and copper*.

For testing *thickness of deposits*, continuing interest was exhibited in *x-rays* and *beta rays*. Achey & Serfass[333] pointed out that *fluorescent x-ray absorption* is a simple method, low in cost and high in accuracy, and the method was employed by Spurgeon & Isaacs[334] for measuring *chromium deposit* thickness on molybdenum alloy turbine buckets. *Zinc coating thickness* on ferrous metal by an x-ray method was claimed by Pellissier & Wicker,[335] a patent was granted to Foley & Perrine[336] on an apparatus for testing *deposit thickness on strip* by diffuse *reflection of beta rays*, and Gabrielson & Ljunggren[337] used these rays for a non-destructive method of *testing lead deposits*.

Coating thickness testers were also patented by Radnor,[338] Martin[339] and Davidson & Rahal,[340] while other thickness test methods were described in articles by Saur[341] and by Cooke & Shanahan,[342] the former using *light interference fringes* for deposits of chromium and other thin films, and the latter comparing the *Kunze-Willey electrolytic method* for tin and tin-iron alloy on tinplate with the weigh-strip-weigh method, finding that the methods agree if deaerated electrolyte is used. Wittrock patented a test for uniformity and thickness of *aluminum coatings on iron*[343] which consisted of repeated, timed immersions in an acid fluoride solution containing copper. This may produce a nostalgic twinge among those old-timers who struggled with the Preece test for galvanized coatings way back when!

The recently developed *sulfur dioxide accelerated corrosion test* was described by Edwards,[344-5] who also reported on the resistance to industrial and marine environments of *bright nickel deposits* from different baths.[346] *Exposure tests* showed that the results were independent of brightener additions. The sulfur dioxide test was also compared to the *acetic acid salt spray* by Hooper,[347] who found that a 24 hr. SO_2 test was most suitable for nickel-chromium deposits on steel but that the acetic acid test was best for deposits on zinc or brass. A comparison, however, between *salt spray and exposure tests* of tin plated copper, by Frant,[348] confirmed the unreliability of the former. Lastly, an *accelerated condensation corrosion test* was developed by Dieman & Gaynor[349] for evaluating rust preventives, featuring short testing time and good precision.

Physical characteristics were dealt with in one article and three patents. Edwards[350] proposed a *spiral bending test*, for ductility, around a mandrel for rather brittle electrodeposits. Campana[351] patented a *wear and abrasion testing machine* for plated articles. Kushner claimed one for a device for measuring *stress in deposits*,[352] and Brescka, Clifford and Moore[353] disclosed an *adhesion tester* which employed adhesive tape. And, when will scientists finally learn that "adherence" is not the same thing as "adhesion"?

Miscellaneous

As usual, each year we end this review with an assortment of developments which, for lack of specific association with any particular phase of the finishing art, we find necessary to group together under this heading. Among such disclosures, Kushner made what would be considered the most complete investigation of *stress* ever attempted, reporting on the factors affecting *residual stress in electrodeposited metals*,[354] and discussing the *role of the basis metal* in particular.[355] Max described the *factors which influence deposit structure*,[356] Odekerken detailed the *causes and cures for pores and pitting*,[357] and Spencer concerned himself with *hydrogen embrittlement* in connection with the *finishing of Springs*.[358] Research on *microthrowing power and leveling* in nickel and copper baths was summarized by Raub,[359] while Rama Char reviewed recent work on deposition of metals from *sulfamate baths*.[360]

Finishing *zinc-base die-castings* received much less attention than the importance of this subject deserves. Spencer outlined *commercial procedures*,[361] Safranek & Faust investigated the use of *electropolishing and electroplating* to improve corrosion resistance and to

reduce finishing costs,[362] and Carter & Edwards, in a study of *service blistering*,[363] concluded that this condition is mainly due to small holes in the copper-nickel coating.

Chelating or sequestering agents were treated in articles by Fishlock,[364] who covered the *value and applications*, and by Smith,[365] who concerned himself with their use in *cleaning and plating*. In an article on the use of *water in the plating shop*, Spencer listed the effects of *impurities and their removal*, [366] while Mohler[367] discoursed on *bulk rinsing*. A patent was granted to Swanton on a procedure for *controlling make-up water additions* to plating solutions,[368] and other patents were issued to Lane for the *removal of chromium contamination* from cyanide baths,[369] and to Ceresa, Crain, and Bohman for *carbonate precipitation*.[370-2]

There was one article on *stripping*, in which Mohler suggested formulas for various metals,[373] and three patents; to Charlesworth for an *electrolytic strip* consisting of sulfuric and phosphoric acid plus a morpholine; to Wasserman for electrolytic removal of *deposits from aluminum*;[375] and to Milo for removal of *tin from iron alloys*.[376] One item on *coloring* appeared, a patent obtained by Mason for cold *chemical oxidation of aluminum* to produce a black finish.[377] Other patents issued were for a method of *jet plating*, claimed by Zimmerman,[378] and a process for *plating split piston rings*, by Chambers & Spaulding,[379] also the use of superimposed alternating current to obtain a *high frequency field* in the solution, disclosed by Hausner.[380]

Plating rack design was expounded in articles by Kraus[381] and by Klein,[382] while improvements in same were claimed by Belke,[383] McGibbon et al.,[384] Hogaboom,[385] Stroinski,[386] and by Schneider.[387] *Anode* improvements consisted of a new *lead anode*, claimed by Belke & Johnson, an *anode rack* for plating *cylinders*, disclosed by Lapham,[389] an *anode basket* to Pociask,[390] and an *anode hook protective sleeve*, credited to Mielke.[391]

Plating equipment innovations included a *rack loader* and unloader for automatic plating machines, disclosed by Mervyn, Listak & Kaden,[392] and *automatic machines* for various purposes, patented by Brower,[393] Rothschild,[394] Gempe,[395] Davis,[396], Kennedy,[397] and Colasanto.[398] A *basket plating apparatus* was patented by Pleadwell,[399] as was a *vibrating* one by Kotz, Dammkoehler & Belke,[400] while *plating barrels* were claimed by Belke[401] and by Jackson.[402] *Controls and timers* were included in patents issued to Rendel[403] and to Hoffman,[404] and an electronic *safety device for periodic reverse plating* without supervision was described in an article by Neill & Langford.[405] Plating *convex articles* was the subject of a patent granted to Hammond & Bowman,[406] and a method of *plating interior surfaces* was disclosed by Curtiss.[407]

Design and engineering of plating departments was detailed in a number of enlightening articles, by McGuire,[408] Kentta,[409] Mohler,[410] Sigman,[411] Bartl & Mudroch,[412] and by Cagle & St. Amand.[413] Calculations of *heating requirements* for solutions were described by Hickman,[414] deciding between *copper and aluminum bus bar* was the subject of an article by Taylor,[415] and Field[416] prepared a *nomograph for measuring loads* of solid flat steel parts.

All in all, comparing the gleanings of the year with that of the previous one,[417] there was just about the same activity in general, and the editor would have been happy to report that finishing is advancing as a science, except for a regrettable tendency, now that *phosphorus* has become a common word as a result of electroless plating, of spelling this element with three o's.

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(*Continued on page* 107)

Organic Finishing Developments of 1958

By Daniel A. Marino, *Asst. Technical Editor*

Application Methods

SPRAYING continues to remain the most popular method of coating industrial products, though specialized types, such as electrostatic,[1] with its numerous improvements,[2-9] and hot spraying[10,11] techniques have received much public attention. A patent was granted to Friedell[12] for a spray and blow gun and to McMaster[13] for a spray booth. An automatic coating spray unit for flocking machines was developed by Friderici[14] while Jewell[15] was granted a patent for a device for spraying internal areas of pipes. Other patents were granted to Krebs[16] for an electric spray gun, Bede[17] for a spray nozzle and Barrett[18] for a plastic spraying apparatus. Other spraying devices were also granted patents.[19-24] Although not as yet mentioned in the technical literature, manufacturers offered two recent developments to the public: a hand electrostatic spray gun and a multicolor electrostatic process.

Weed[25] showed where economies may be introduced to the spray painting shop by substituting divorced motor pumps for the more commonly used types. Especially when handling abrasive coating materials, because the paint is pumped through an outboard riser tube (and does not come in contact with the motor) an efficient long life system may be expected.

The vacuum metalizing process which utilizes all of the common coating methods, such as, spraying, dipping, flow coating, for applying top and base coats, continues to gain in popularity. This is particularly true in the automotive field where sizable savings have been derived from substituting vacuum metalizing for chromium plating.[26] Though there is much evidence that a sizable number of flow coating units were installed in the past year, relatively little was published concerning the process.[27,28] Only one article[29] describing airless spraying was published (which is in sharp contrast to the previous year) and a flame spraying technique was discussed by Payne.[30]

Cox[31] obtained a U. S. patent for an electric paint removing tool while roller coating developments showed an unusually high activity.[32-39] That brush painting remains prominent is evidenced by the numerous patents granted to paint brush developments, such as, a rotary paint brush,[40] and others.[41-43] A patent was granted to Ransburg[44] for a dip coating machine.

Materials for Coatings

An epoxy material was introduced which produces a hard, chip-proof, scuff-resistant surface with good adhesion, even on phenolic molded parts.[45] Glaser[46,47] reported that either of three paint primer systems, all containing chromate ion inhibiting pigments, may produce a substrate for magnesium alloys having good film properties, even when subjected to cyclic high humidity and high temperature. The systems are: an epoxy polyamide primer-enamel; a tetrapolymer silicone primer-enamel; an epoxy ester silicone primer-enamel. Dunn[48] showed that because urea and melamine formaldehyde modified epoxy ester coatings have good drying properties, more successful utilization of them may be found in the metal litho industry.[49]

Baldwin[50,51] discussed the performance of various one and two component polyurethane systems as related to the protective coatings field and Beck[52] showed how silicone oils have become indispensible in paints for producing hammered patterns. Without these oils, one-coat hammer coatings may not have gained the widespread appeal which they currently enjoy.

Aluminum containing resins, which are formed by replacement of the phenolic compounds used in the manufacture of phenol-aldehyde and phenol-ketone by their aluminum salts, is the subject of a British patent[53] which claims for the system such advantages as, lower baking temperatures and harder dry films. Alkyds and modified alkyds[54-55] as well as polyester lacquers[56] and acrylic resin emulsion paints[57] were discussed in the literature.

Beck,[58] in reviewing lecithin as an anti-settling agent, indicated that a given baking enamel containing the material may display a high gloss when sprayed and a hazy flatness when poured or dipped.

A study conducted by McKinney[59] indicated that paint manufacturing equipment will be more serviceable when it has been electropolished prior to using. The surface produced by the electropolishing is easy to clean, less likely to incorporate corrosion products into the mix, and less liable to accumulate adherent deposits.

Kelly, [60] in reviewing the chemistry, manufacture, and history of chlorosulfonated polyethylene as well as the preparation, pigmentation, curing and prop-

erties of paints containing it, indicated that newer members of the chlorinated polyethylenes promise to provide harder films with good elasticity. A relatively new type of green pigment,[61] phthalocyanine green, may be produced by fully chlorinating the phthalocyanine blue molecule. The phthalo green produced is practically flocculation-resistant and has no tendency to change in crystal form as does the untreated phthalo blue. Korshak and associates[62] found that by copolymerization of the vinyl esters of fatty acids with tung oil or other unsaturated compounds, paint media are obtained which could substitute for natural oils.

Surface Active Agents

Much evidence was found by Allan[63] to support the theory that the drying process of oils and oil-modified resins occurs by reactions involving the formation and breakdown of hydroperoxides with the formation of free radicals. Results of practical tests indicate that the best drying characteristics are obtained with the correct balance of through driers and surface driers; also, that each system tends to be specific in its requirements.

It was shown by Beck[64] that even the new octoate driers (which are produced from the aliphatic acid 2-ethyl hexoic acid) might be expected to be less stable than the more popular naphthenate driers (which are prepared from naphthenic acid), performance of the octoate type driers has actually shown it to be the opposite case. Though the octoates are more expensive than most common driers, their superior characteristics, such as less staining and odor-free, their usage may frequently be justified.

Specialized Coatings

A number of organic coating compositions[65-8] were granted U. S. patents, among which was a paint containing an aqueous polymer and described as freeze resistant.[69] Barnebey[70] was awarded a patent for a method of hardening organic coatings by treatment with sulfur dichloride vapor.

Self-luminous coating materials containing tritium, krypton, stronium and thallium are being used as substitutes for electric light illuminating devices. Their use, however, is presently restricted to military equipment.[71] Letsky,[72] in reviewing various special finishes and their uses, concludes that the phenomenon of wrinkling is caused by differential hardening of the coating during curing. The author puts forth a series of broad possibilities which show evidence for his illation. Vinyl-metal laminates continue to grow in importance — from one million sq. ft. in 1955 to over 18 million in 1958. An even greater future is being predicted for the material, with conservative estimates[73] indicating that usage will be over 110 million sq. ft. by 1960. The smoothness and high gloss produced by the chrome type aluminums strongly resemble the brilliant and metallic effect of a chromium electroplate. The effect is attributed to the orderly manner in which the aluminum (which is specially treated) tends to leaf in the coating.[74]

Microbe Resistant Paints

Self-sanitizing paints continue to make news in the organic coatings field. These paints, which have antimicrobial compounds in their formulations, impart to the coating "cidal" or killing action upon microorganisms alighting on them. Klens [75,76] discussed the basic mechanisms and methodology involved in determining whether a surface exerts a killing action upon microorganisms in contact with it. Shapiro,[77] after comparing various fungicidal materials for paint coatings in the Panama Canal zone, concluded that tetrachlorophenol appeared to be a most outstanding fungicide for use in paints (of the TT-P-102 type) discussed in his paper.

Wash Primers

A number of patents were granted to compositions falling in the wash primer class,[78-80] including one to Bruxelles[81] and another to Gaul[82] for a nitrocellulose, chromium trioxide, and phosphoric acid composition. Spencer[83] described both the one and two package wash primer systems (using formulae) for coating aluminum, and Beck[84] showed how, with the aid of a wash primer, vinyl-alkyd coatings may provide satisfactory adhesion. He further indicated that the adhesion of a wash primer (within limits) is directly proportional to the quantity of phosphoric acid it contains.

Costelloe[85] found that zinc tetrahydroxy chromate is a superior zinc chromate for wash primers to be used on zinc surfaces and which are to be subjected to high humidity conditions. This is because the tetroxy chromate exhibits rapid initial leaching rate of active chromate ions, which is essential for zinc surfaces under these conditions, in order to achieve a rapid passivation at the zinc-organic film interface. He further found that the use of a wash primer on phosphated zinc surfaces does not normally produce a very high standard of adhesion. Clay,[86] on the other hand, found that a mixture of 60 parts zinc oxide and 40 parts zinc potassium chromate is superior to zinc tetroxychromate. He further indicates that barium chromate shows considerable promise as a pigment for single package wash primers.

Wash primers were shown to have excellent ability to prevent rust creepage.[87] In a series of steel test panels having a variety of primers, including a zinc dust oxide, zinc chromate alkyd, red iron oxide alkyd, single package wash primer, and others, and which were subjected to a corrosive environment, the wash primer undercoat not only provided the best interface adhesion, but also retarded rust spots from forming on the exposed underlying steel.

Analysis and Testing

Techniques

Liff,[88] realizing that with normal methods of spraying nitrocellulose lacquers there is a tendency for water to be deposited with the film, described a device designed to control humidity conditions during spraying thereby enabling investigation of blushing performed under conditions free from supervenient mois-

ture. The electron microscope was utilized by Twiss[89] for studying the effects of weathering of automotive finishes. Both a typical chalking type finish and a checking type finish were compared in natural and accelerated weathering and discussed at length. It was found by Shaw[90] that degradation of organic coatings may be followed by alternating current impedance measurements of the coated panels immersed in electrolytic solution. The degradation is accompanied by a decrease in impedance, which can best be interpreted by either an increase in series capacitance or decrease in parallel resistance. This method of testing has the advantages of designating relative degradation in terms of instrumental values and detecting changes in coatings long before they become visible. It, therefore, could eventually became a valuable supplement to salt spray and other accelerated weathering tests of organic coatings. Ivanovszky[91] indicated that, although not fully developed at this time, the application of the techniques of chromatographic separation to the analysis of waxes and polishes is proving a great success.

A review of many of the more important standard tests for organic coatings was presented by Allen,[92] while Horrocks[93] evaluated the effects of nuclear radiation upon six organic coatings. Euverard[94] and Radnor[95] were granted patents for dry film thickness gages.

Materials and Coatings

It was shown by Reinsmith[96] that gamma irradiated organic coating materials may improve them in one series of properties while deteriorating them in another. Tensile strength may increase while elongation decreases, or vice versa: or elongation may increase at the expense of softening the material. Specific qualitative tests were outlined[97] for urea- and melamine formaldehyde, isocyanate and polyurethane resins, using p-dimethylaminobenzaldehyde as a reagent.

The National Association of Corrosion Engineers, in a technical report[98] concerning organic coatings for chemical resistant linings of tanks, reviewed recommended resins for lining purposes. Nowacki[99] described methods of evaluating protective linings for shipping containers.

Color

Holle[100] showed how four sciences—physics, chemistry, physiology, and psychology—play a major role in color perception. By improved methods, time required to train color matchers has been reduced from ten years to six months. Gilbert[101] studied 355 unselected subjects (180 males and 195 females) between the ages of 10 and 93 in order to determine age changes which occur in male and female subject in color matching. Shades of blue and green proved to be more difficult to discriminate between than shades of yellow and red at all ages, and the ability to discriminate between these shades also showed a more rapid decline with age. At all ages, but particularly in the sixties, wide individual differences were found in the subjects' abilities to match colors.

Adhesion

A method of measuring adhesion was described[102] by Imperial Chem. Industries (England) which minimizes the effects of such film properties as hardness, flexibility, and brittlement. The paint is applied to wood discs having high permeability to air. An air pressure is applied to the uncoated side until the film is lifted. Dintenfass[103] described the complex forces responsible for adhesion of paint films to substrates along with the effects on adhesion of the presence of solvents and pigments in the paint film, while Yamaguchi[104] showed and described the relationship which exists between surface potential of a metal and the adhesive property of an organic coating applied to such a surface. A mixture of ethyl alcohol when applied to aluminum, decreases the surface activity and approximately proportionately increases the adhesive strength of a subsequent organic coating.

Another method of measuring paint adhesion was recently announced.[105] The paint and its support are shot at a great speed against a target that holds the support but allows the paint to fly off (through a hole in the target) when the speed is great enough to develop sufficient force on impact to remove the paint. A series of tests are made, firing a number of bullets at gradually increasing speeds until the spot of paint is completely removed. From the weight of the paint and the removal speed, the adhesion of the paint can be calculated.

Water Thinned Paints

Water emulsion and solvent paints are continuing to attract attention. A Swedish firm is marketing a coating material[106,107] based on both phenolic and melamine resins. The material, which is completely soluble in water, provides a continuous film on drying.

In the light of their numerous advances, Brenner[108] compared paints composed of styrene, butadiene, polyvinyl acetate, and acrylics. Others also reported on similar subjects.[109,110,111]

Swann,[112] in reviewing paint materials in which water is used as a solvent as distinct from the so-called emulsion paints in which water is dispersed in an oily, oleoresinous, or alkyd vehicle, indicated that those coatings based on baking systems are the superior. This is primarily because baking induces further chemical reaction which more readily modifies or completely eliminates hydrophilic centers in water solvent paints.

Hazards

In a review of fire hazards and their avoidance in the field of organic coatings, Smith[113] indicated that cellulose nitrate deposits are the most hazardous of those most commonly used; once ignited, they burn with an extreme vigor and are very difficult to extinguish.

Beck[114] warned paint formulators who would use zinc dust in their coating materials, to use care in preventing water from entering the mixture. Hydrogen gas build-up in the unvented package has been responsible for bursting accidents. Zahn[115] concluded that a two-shot fire extinguishing system affords a big protection against extra production losses from idle equipment.

A comparison was made by Goldberg[116] of the antifungal and antibacterial activities of phenylmercuric and tributyltin compounds. Not only was the latter found to be superior with regard to the above activi-

ties, but also, when used in recommended concentration, the hazard arising from the possibility of contamination of foodstuffs by flaking of an antifungal phenylmercuric paint is negligible.

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HARD NICKEL PLATING IN RUSSIA

Sulfate - Oxalate Bath

By A. J. Steiger

METAL finishing engineers in USSR have developed an electroplating process for producing a hard bright nickel deposit from oxalic acid electrolytes, it is reported in a recent issue of *Priborostroyeniye*, organ of the Russian instrument building industry.

The process was developed, the journal said, by the Scientific Research Institute of the Calculating Machine Industry in the course of experiments designed to improve on the chromium plating methods used, and found wanting, to get a good wear-resistant finish on profiled parts installed in electronic and electromechanical computers.

Finding chromium plating deficient, the computer industry research in Russia turned to other metals and alloys, such as iron-manganese-nickel and iron-nickel, but without effective results in plating machine parts having particularly complex profiles, the Russian report stated. The electroplating tests were made in sulfates of iron and nickel with an addition of ammonium oxalate.

Preliminary research established that, other conditions being equal, deposit hardness depended on the iron content of the electrolyte, being greatest when the latter was minimal. On this basis, the journal reported an electrolyte was developed from nickel sulfate and ammonium oxalate, which does not contain any salts of iron.

In the oxalic acid electrolytes, the nickel is deposited 5 to 6 times faster than in ordinary sulfate baths, and

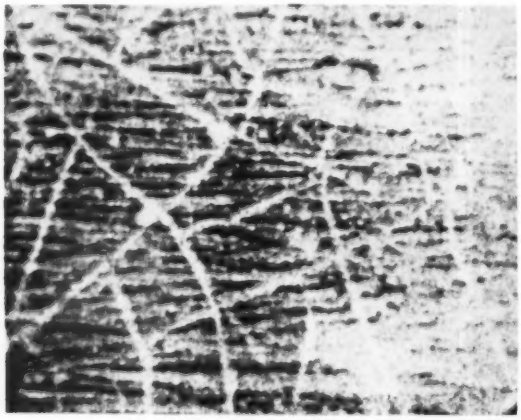


Fig. 1. Surface of nickel deposit formed in oxalic acid electrolyte. x100.

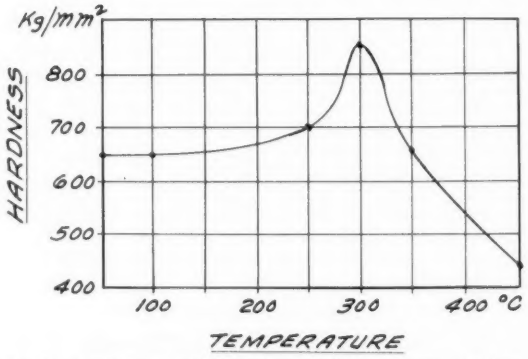


Fig. 2. Variation of nickel hardness with temperature, for heat treatment of 1 hour duration.

is more than twice as hard, the Russian research report said, giving a complete run-down of the process used and how it was developed.

Technical Details

The deposits of nickel formed in the oxalic acid electrolyte are marked by high-grade hardness and smoothness, requiring no additional polishing, said the Russian engineer, *E. F. Lyakovich*, who authored the report. It was observed that the tank material dissolving in the electrolyte often contributed to deterioration of the quality of electrolytic deposits. Tests showed that the most resistant tank material is stainless steel. Admixtures in the electrolytes also have a substantial effect on the quality of the electrolytic deposits of nickel. In an electrolyte composed of nickel sulfate and ammonium oxalate, the rate of deposition rises with increase in nickel sulfate concentration, but hardness of the deposit decreases. A nickel sulfate concentration of 140 g./l. is most satisfactory. The brightest and smoothest nickel deposits are obtained at a temperature of 70 to 80°C. (158 to 176°F.).

In a freshly made solution of nickel sulfate and ammonium oxalate the pH is 6.2 to 6.8 with the quinhydrone electrode. The tests showed, however, that there is no direct dependence between the hardness of the cathode deposit and the electrolyte's acidity. The acidity has a very great effect on the rate of deposition; the higher the pH value, the faster is the rate of nickel deposition. At a constant pH value, the nickel deposition rate increases with increase in current density. It is most expedient to carry out the nickel deposition at

pH of 7.5 to 8, because at higher pH values the cathode efficiency diminishes.

At current densities of the order of 0.5 to 1 amp./dm.^{2}, the deposits become quite dark and coarse. The appearance of the deposits is appreciably improved with increase in current density but, at 15 amp./dm.^{2}, the deposits began to crack at the edges. However, the current density has little effect, in general, on the hardness of deposits. At a current density of 10 amp./dm.^{2} and pH of 7.5 to 8, the average cathode efficiency is 40 to 45%. Under the same conditions, the anode current efficiency is 8 to 10% lower than the cathode yield.

The throwing power depends, to a large extent, on current density, as the tabulation shows:

Current density amp./dm.^{2}	*Throwing power*
1	86
5	66
10	35

Raising the current density causes an increase in the coating's porosity as well. The pores of electrolytic nickel deposits formed in oxalic acid electrolytes have the character of a network of fissures (Fig. 1). The porosity declines, however, with increase in the thickness of the deposit. The pores retain lubricant very well, it was noted.

At low current densities, the nickel deposits formed are black. This is caused by the inclusion of carbon in the composition of the cathode deposit. The carbon content in the deposit declines with the rise of the electrolyte's temperature, as is evident from the tabulation below:

Temperature °C. and °F.		*Carbon content %*
50	122	2.78
60	140	1.66
70	158	1.11
80	176	0.75

The carbon content was determined at current density of 10 amp./dm.^{2} and at pH 7.0.

At a temperature of 70°C. and various pH values, the following tabulated relations exist between the current density and carbon content in the cathode deposit:

Current density amp./dm.^{2}	*pH*	*Carbon content %*
5	6.5	0.98
10	6.5	0.86
15	6.5	0.86
5	7.5	1.38
10	7.5	0.95
15	7.5	0.65
5	9	0.73
10	9	0.73
15	9	0.72

The carbon content in the deposit rises with increase of the ammonium oxalate concentration.

It was noted that the covering power of the baths is improved by the organic admixtures that are especially prepared for oxalic acid electrolytes by the Institute of Chemical Reagents. But these admixtures disintegrate very rapidly and, for this reason, their use was rejected. Among inorganic admixtures, ammonium

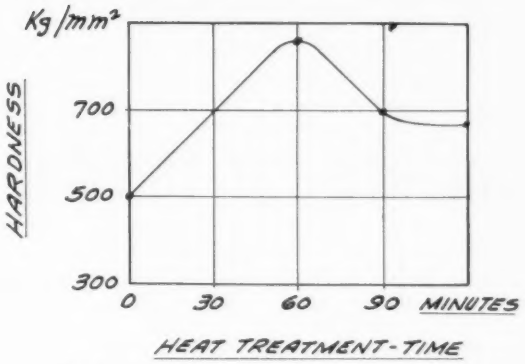


Fig. 3. Effect of heat treatment on nickel hardness.

fluoride and chloride cause some increase in the solubility of anodes; however, they impair the appearance of the deposits. Furthermore, the use of boric acid interfers with maintenance of pH values in the range of 7.5 to 8. The investigations thus showed that it was not expedient to introduce admixtures into the electrolyte.

The prolonged experiments carried out resulted in the adoption of the following electrolyte composition and operating conditions for getting hard nickel plating:

Nickel sulfate	140 g./l.
Ammonium oxalate	300 "
pH	7.5-8 electro.
Current density	10 amp./dm.^{2}
Temperature	75-80°C.

When this electrolyte is used under the conditions set forth, the rate of nickel deposition amounts to 50-60 microns/hour (0.002-0.0024"); at the same time the deposits have a hardness characteristic of the order of 550 to 650 kg./mm.^{2}.

Thus, the rate of nickel deposition in oxalic acid electrolytes exceeds 5 to 6 times the nickel deposition rate in ordinary sulfuric acid electrolytes, and the hardness of deposits is 2 to 2.5 times higher. The coating obtained in oxalic acid electrolytes has a smooth brightness and does not require additional brightening.

Raising of the pH value in the oxalic acid and electrolyte is achieved by the periodic additions of ammonia.

It was established that the bright and hard nickel deposits can expediently be subjected to heat treatment in muffle furnaces for the purpose of increasing their hardness still more. Thus, at 300°C., the hardness of the nickel deposits is raised by 200 to 250 kg./mm.^{2} and approximates the hardness of chromium. It should not be overlooked, however, that further rise of temperature as well as increase in the duration of heat treatment, can bring about a decline in the coating hardness (Fig. 2 and 3).

The heat treatment appreciably enhances the corrosion resistance of the nickel deposits formed in an oxalic acid electrolyte. Without heat treatment it is inferior to the anticorrosive properties of deposits formed in sulfuric acid electrolyte. Moreover, the heat treatment imparts a golden tinge to the nickel deposit.

Science for the Coatings Technologist

Part XII. Paint Additives - Mildewcides

By E. S. Beck

THE control of the growth of fungi and bacteria on paint has assumed great importance in the post-war years. It is true that the problem has always been with us. But what we now recognize easily as mold on painted surfaces, we formerly dismissed as dirt collection. Many types of mold growth on paint look so exactly like ordinary dirt collection that microscopic examination is required to identify the mold. The pattern of growth, however, is usually very characteristic, and those with experience can readily identify mold growth by inspection in most cases.

One reason for the lack of discrimination between dirt collection and mold growth is that sometimes the two factors are tied up together. In the case of ordinary oil-containing paint films, the film itself can supply nutriment to the micro-organism. But mildew can also form on surfaces which contain no nutriment, such as asbestos shingles. It can be shown that such surfaces can be kept cleaner of "dirt collection" if a mildewcide is included in the composition. It is believed that normal dirt collection provides enough nutriments to keep certain microorganisms alive. These grow and flourish, and their growth provides a surface upon which more dirt can collect. This, in turn, provides food for still more microorganisms. And so on. In this case, the non-nutritious substrate serves merely as a table upon which the food of the micro-organism is spread. If the growth of the bacteria had been inhibited initially by the presence of a mildewcide, large-scale dirt collection could have been avoided.

Perhaps the most work on the subject has been done in the field of wood preservation. Here the effects of bacterial and mold action on untreated wood are all too obvious. Wooden products such as telephone poles and fence posts can be protected against rot for periods up to twenty years by use of the proper materials. A great deal of what has been learned in the use of wood can be transferred to coatings.

It would appear that none of the wood treatments is completely permanent, nor effective against all organisms. What is usually sought is a compromise between price and a reasonable period of service. In most cases, a mixture of preservative agents is more useful than a single material. This is because of the wide variety of bacteria and molds which must be resisted. Some have better tolerance for any given agent than do others.

Even such a widely-used and highly-respective preservative as creosote oil is not effective against all micro-organisms. There is at least one variety of mold which can live in a high concentration of creosote. It may even utilize the phenolic materials present in the creosote in its metabolism. This particular mold (Hormodendrum resinae) is very susceptible to other mildewcides, however. Furthermore, the main reason for its ability to flourish in an atmosphere of creosote seems to lie in the fact that the creosote kills other competitive micro-organisms.

Some of the materials used in wood preservation, especially mercurials, chlorinated phenols, creosote products, and salicylanilide are also used in paints. Some of these products have very limited utility in most coatings because of odor, staining, or inhibiting action on the drying of paints. Creosote, for instance, is used today almost exclusively in dark stains for

(Courtesy of Nuodex Products Co.)

Fig. 1. A Discolored House. Mildew or Dirt?

A large-scale survey of discolored houses in the eastern U. S. brought to light the surprising fact that more than 60% of these houses were discolored by mildew rather than dirt. Now that the technical people of the paint industry are aware of the mildew problem, it is to be hoped that the number of discolored houses will be greatly reduced in the future.

wood, not to be recoated with other types of paints. The creosote is effective in protecting the wood from mold (there is generally no film of paint left on the surface). But it has a strong, offensive odor, it is very staining (no drawback in dark colors, but it would bleed badly into a light finish) and would slow down the dry of an oil paint applied over it.

In addition to the increasing awareness of the mildew problem in exterior house paints, we are also coming to realize how great the concern is to produce mildew-proof interior coatings for a great many applications. As the various state and federal food and drug regulations become increasingly strict, the need for mildew-free interior walls, benches, tables, etc. increases.

Not only is interior cleanliness mandatory in food and drug plants, but freedom from mold is especially urgent. Many food products, for instance, are inspected for cleanliness by checking for traces of mold contamination. The growth of mold on the walls of the food plant itself would be intolerable.

The demand for mildewproof paints for such industrial applications is rising. Even with the frequent washings and disinfectant treatments adopted by careful manufacturers, mold growth is becoming more of a problem. And it has been demonstrated that properly protected paint can greatly reduce the growth of mold without introducing any hazard of toxicity. Thus, it can be seen that the increasing attention which is being given to mildewcides today is based on a solid need and interest on the part of paint users.

There are two functions which a mildewcide may be called on to perform. The first is to protect the paint from the action of microorganisms while it is in the package. The second is the more common and well-known use of protecting the dry film of paint itself. The package protection is needed only with water-type paints as the popular emulsion products of today or the casein paints of yesterday. The film protection, while needed for both latex and for solvent type paints, is more needed (and harder to provide) in the case of normal oil paints.

For the preservation of latexes, perhaps the mercury compounds, such as phenyl mercury oleate, mercury naphthenate, etc., are the most widely used. Familiar from food applications are sodium benzoate (only moderately efficient) and from drug and cosmetic applications come amine and phenolic compounds. Again, mixtures are frequently more useful than single materials.

Spoilage in the container in the case of latex paints is not always easy to identify. If casein is present in a stabilizing agent, microbial spoilage will be accompanied by gas and a bad odor. In other cases, there may be gas, but little or no odor. Rarely is there a significant gas pressure. Stringiness or sliminess may be present; and the ultimate would be gelation of the finish.

Even though only slight signs of attack by microorganisms may be noticeable, if these organisms are growing actively in the paint package, they will have a head start in causing failure of the film. For this additional reason, therefore, it is advisable to keep microorganisms under control in the package. Not only must preservatives be used in the water-based coating, but a reasonable degree of care and cleanliness must be followed in the manufacturing process. Tanks and mixers must be cleaned frequently with disinfectant and hot water. Pipelines especially, must be kept clean. Mold grows well in the bends of pipes in latex residues. If the pipes are not clean, each batch passing through will become contaminated in its turn.

Before we consider the matter of protecting dried films from mildew, it will be worthwhile to review the biology of mildew in a brief way. The principal offenders in the paint world are a few groups of bacteria and a fairly wide group of families of fungi or molds. Often the two are found working together; and many investigators in the field consider such relationships to be symbiotic. There is one school of thought today which holds that mold cannot attack a film unless the way has first been prepared by bacteria.

Both molds and bacteria are considered part of the plant kingdom. Bacteria have been the subject of much debate since their discovery. Some biologists avoid the decision as to their animal or plant nature by placing bacteria in a sub-kingdom by themselves. This was proposed by Haeckel, then altered by him, finally abandoned. But many biologists still tend to treat bacteria as a separate sub-kingdom, and others prefer to consider them as animal. Certainly they do not possess two important plant characteristics: a cell wall of cellulose and the presence of chlorophyll. On the other hand, they form spores (a typical plant characteristic) and possess chemosynthetic power. In any event, bacteria are extremely small, and not visible to the eye, except in the form of their colonies, which represent multitudes growing together in a cluster.

Molds are botanically classed as thallophytes, that is, plants without distinction of root, stem or branch. The characteristic feature of molds is the thread-like form, known as hypha. The entire mass of hyphae is called by the more familiar term of mycelium. It is this characteristic thread structure which is used to identify the molds on paint film. As the structures are relatively large, only a low magnification is needed to see the features plainly.

Since molds do not possess chlorophyll, they cannot utilize light energy in their body metabolism in the manner that the higher plants do. This is one of the reasons for the wide-spread conviction that the molds must have darkness to grow. It is true that most molds do better in the dark than in the light, but many, if not most can grow quite well in the light. A few actually grow better in light than in darkness.

Molds do need water. They do not flourish in dry, arid circumstances. Despite widely held opinion, they are not influenced by the relatively humidity. They need liquid water on or in the substrate in order to grow. If the substrate is on a basement wall or other cool surface, high humidity may contribute to mold growth through the mechanism of condensation. The reason for the necessity for water lies in the manner of the molds' ingestion of food.

The mold secretes externally enzymes which attack the substrate and convert it (or part of it) into materials which the mold can ingest and metabolize. The presence of liquid water is essential for the enzyme to work on the substrate, and for the soluble end-products

to reach and be absorbed by the mold itself. The oils in paints can provide food for the molds, as can surface dirt.

The most common mold families involved in paint mildewing are *Aspergillus, Penicillium, Alternania, Phoma,* and *Pullaria,* although there are perhaps a dozen others as well. *Pullaria* is considered by one team of researchers to be the principal factor in all paint mold growth. *Aspergillus* is the mold most commonly found on foods (especially *Aspergillus niger*) and its spores are everywhere. Its enzyme is active against carbohydrates. *Penicillium* is the mold which produces the valuable antibiotic penicillin. One variety also is the causative mold in the preparation of Roquefort cheese. *Penicillium* molds are green, *Aspergillus* black (in the visual appearance of the colony).

Not only do these molds cause the surface of affected paints to look dirty: they also consume the vehicle of the film and will weaken the film by erosion and holing. The dirty appearance caused by the mold cannot be removed by washing. Mold is frequently deeply embedded in the paint. Sometimes, in fact, the mold works its way through to the surface from the undercoat or even from the wood surface.

The best way to handle this problem is to prevent it from arising, as far as is possible. Much intensive work has been done and is under way to find the best solution to the quite difficult matter. At the present time, the only truly satisfactory approach is two-fold. Not only must the paint contain one or more mildewcides, but the basic formulation must be designed with mildew control in mind.

Let us consider the basic formulation first. Certain materials seem to foster mildew formation more strongly than do others. Even the choice of extenders is significant in this connection. Magnesium silicate, an otherwise excellent outdoor extender, seems to promote mold growth. Possibly this is because of the rougher surface it produces. More dirt may be caught and held, hence more mold can take hold. In any event, the replacement of magnesium silicate by calcium carbonate makes a great improvement in the mildew resistance of the coating. Unfortunately, the durability is not improved by this change. The tendency to chalk and to color-fade is reduced, it is true. However, the film produced is denser and harder, with more rapid failure by cracking. The tendency can be kept to a minimum by the use of coarse ground limestone as the preferred form of calcium carbonate.

In the case of whites and light colors, the choice of titanium dioxide pigment is important. In general, the freely-chalking types show less tendency to mildew than do the non-chalking. However, the freely-chalking types erode rapidly, and do not provide durability for an acceptable period of time. Perhaps two years is the best that can be expected from a very freely-chalking formulation. There is the further drawback that the washed-off chalk will stain brickwork, windows, walks, etc. This approach to reducing mildew has too many drawbacks to be widely adopted.

Anything which tends to produce a hard, smooth film will reduce the growth of mildew. This would indicate modification with hard gums and the use of enamel type vehicles. Unfortunately, experience with this type of product has shown that there is a great loss of durability. Perhaps as far as can be gone in this direction is the modification with long oil alkyd resins, or the use of extremely long oil alkyds as the sole vehicle. In general, the paint industry is very cautious in making changes in the vehicle of exterior house paints. Time has shown that straight linseed oil possesses the necessary durability, as do the long oil alkyds. Other materials will have to pass prolonged durability tests and other performance tests before they can be considered.

Zinc oxide is the prime example of a pigment which hardens the film of an oil-bearing paint. And it is the most useful of all the standard materials in making a coating resistant to mildew. In fact, the value of zinc oxide is so great in this respect that it must be considered almost as a specific. If 2 to 3 pounds of zinc oxide are present in an outside house paint (based on linseed oil) the resistance to mildew is greatly enhanced. This type of paint is easy to control with a small amount of additional mildewcide. In fact, it is only since zinc oxide was withdrawn from many outside paints that the problem of mildew control has become so extremely difficult.

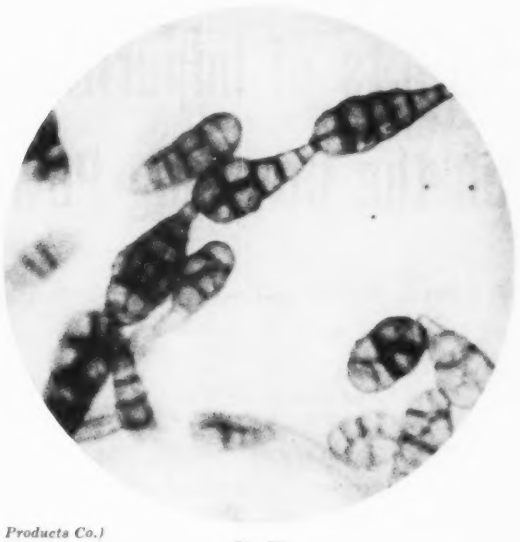
However, it is not good formulating to use such amounts of zinc oxide in outside house paints. It has been repeatedly demonstrated that the durability suffers markedly. The film becomes too hard, and there is failure by checking or cracking. There is also a real problem with repaintability. Zinc oxide seems to promote peeling and blistering, especially if it is in the undercoat. And every paint on a house will serve as an undercoat when it is repainted. Many firms have removed zinc oxide from their primers; and one of the more important federal specifications for primer is now zinc-free. The condition is even worse if all or part of the vehicle of the paint is an alkyd resin.

This seems to leave us in the position that much good can be done by altering the formulation, but that all such alterations are unfavorable in other respects. Once again, we are encountering the need for compromising opposing factors. Each laboratory or formulating group has its own ideas and approachs to this problem. While it cannot be said that anyone seems to have solved the basic problem, some have produced compromises which are acceptable, at least by present standards.

Because the formulations which give the best mildew resistance cannot be used (owing to unsatisfactory properties in other respects) we must depend upon additives to carry the larger part of the load. It must be emphasized that the additives alone cannot do the job either; and as much resistance as possible must be built in via the formulation.

Mildewcides in general fall into the group of universal poisons. Such substances as mercury, phenols, etc., are poisonous to all forms of life. They can be used because the amounts necessary to kill or inhibit mold and bacteria growth are usually not enough to bother humans. Of course, the search is always on for materials which will show a differential killing ability, and be more toxic to micro-organisms than to warm-blooded animals. Some distinct progress has been made in this direction.

The ideal mildewcide would be non-toxic to humans, permanent, low in price, effective against all micro-



(Courtesy of Nuodex Products Co.)

Fig. 2A Fig. 2B

Fig. 2. Two Typical Molds.
Both of these views show the molds magnified 100 diameters. Fig. 2a, on the left, illustrates "Phoma." Fig. 2b shows "Alternaria." Both of these are relatively frequent offenders on paint films.

organisms, colorless and non-staining. It could have a few other properties as well, but these would suffice. Needless to say, there is nothing available which meets all these requirements. Perhaps the chief problem today is with price. Even bad (from the point of view of mildew-resistance) coatings can be protected if enough mildewcide is added. At a factory cost of $0.50 to $1.00 per gallon, some pretty good results can be obtained. Such increases are prohibitive, of course.

With compromise formulations, designed for maximum mildew-resistance, much smaller amounts of mildewcides can be used with acceptable results. It cannot be said that all the answers are in, however, or that truly all-around mildew-resisting paints of top quality are common. One of the problems is the difficulty of running elimination tests; and the rather long period of time it takes to obtain even preliminary results. Add to this the unfamiliarity with bacteriology and mycology which prevails in almost every paint laboratory, and the dimensions of the problem become more evident.

Many attempts have been made to obtain rapid test results in the laboratory. Screening of new types of mildewcides is generally performed in the laboratory in Petri dishes. The efficiency of various materials can be rated against specific organisms (usually three or four different molds are used) and compared with known standards. Such tests require only a few weeks as against the years of outdoor exposure necessary to obtain practical empirical results. However, this rapidity of Petri dish tests is partly counteracted by the lessened reliability of these data in comparison with exposure or other actual usage tests.

Mildewcides can be evaluated directly against cultures of various molds. But in materials designed for use in paint, it is perhaps better to test the agents in the paint itself. A widely-used procedure is to coat pieces of filter paper with the paint alone, and with the paint to which has been added the different mildewcides which are to be evaluated. In some cases, the test papers, after thorough drying, are leached thoroughly with water. This is to establish if the mildewcide is permanent to water, as might be encountered with rain or dew.

The coated papers are then cut to a specified standard size, flash sterilized in boiling water, and placed on the surface of a nutrient culture medium, which has been previously inoculated with a dispersion of a standard culture of a specific mold. A small quantity of the mold dispersion is then placed upon the surface of the paper as well, and the dish closed. It is incubated at a standard temperature and humidity for three or four weeks, with inspections at standard intervals.

An efficiently protected coating will show little or no surface growth of mildew upon the paper. An unprotected coating will generally show abundant mildew growth, unless the basic formulation is inherently mildew-proof. In some cases there will be a zone of inhibition around the paper, showing that the activity of the mildewcide extends beyond the border of the paper into the culture medium itself. This is generally seen with highly active materials which also show a degree of solubility sufficient to build up a concentration of some effectiveness around the paper. Incidentally, it was just such a zone of effectiveness around some penicillium colonies which was observed by Fleming, leading ultimately to the development of penicillin. These were not paint tests, however, and the activity was against bacteria.

Now we are in a position to look briefly at a number of the more important mildewcides. It will not be necessary to cover all of the materials which have been used for this purpose, for they are almost legion. Usage has gradually reduced the field down to three major categories: mercury compounds, phenolic compounds, and copper compounds.

(To be continued)

Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath

By Robert H. Rousselot, *Electrolysis Laboratory, French National Center for Scientific Research, Paris, France*
and Georges E. Rousselot

This is the second and final installment of the article by Messrs. Rousselot. The first part appeared in the December 1958 issue.—*Ed.*

TIN:

a. Tin in nickel baths may result from the attack of tin alloy or bronze pieces which are poorly covered in recesses by the preceding copper plating, or it may come from soldered joints.

In our experiments, tin was introduced as stannous chloride ($SnCl_2 \cdot 2H_2O$), acidified by HCl.

b. 1. Around 50 mg./l., tin causes a slight improvement at high c.d., and then this improvement disappears and a slightly hazy deposit with pits is obtained.

2 & 3. The maximum allowable concentration (x) for the appearance of the plate is 50 mg./l., but a beginning of precipitation is noted at pH 3.5.

4. Thus, the solubility limit would seem to be near this figure.

c. 1. The curve in Fig. 8 shows a slight improvement in the CP around 50 mg./l.

2. A small quantity of tin seems to have a favorable effect on the covering power.

d. 1. Chelation by EDTA-Na_4 as well as reduction by $Na_2S_2O_4$ of 100 mg. of added tin per liter make for an improvement by eliminating pitting, and the quality of the deposit obtained is equivalent to that given by the stock solution.

2. Tin seems to be eliminated automatically by hydrolysis and precipitation, even in low concentrations, so that it is not necessary to consider removal methods for this impurity.

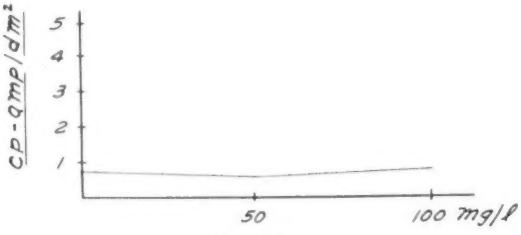


Fig. 8. Tin

CADMIUM:

a. Contamination by cadmium can only be accidental, since this impurity does not normally exist in either the chemicals or the anodes. For our experiments, cadmium was introduced as a $CdCl_2$ solution:

b. 1. When the cadmium concentration is increased from 0 to 700 mg./l., a dark, depressed area is observed at low c.d., accompanied by pits which develop and form heavily marked streaks. At medium c.d. the deposit, which is first milky and then uneven, finally becomes deeply streaked as at low c.d. However, at high c.d., an increasing number of pits appear, with their surface spreading and assuming the form of small craters with vertical "tails."

2. Strictly speaking, Cd does not cause an absence of nickel plate at low c.d., but gives a very thin deposit in the form of depressed areas.

3. The maximum concentration (x) is around 75 mg./l.

4. The limit of solubility was not reached.

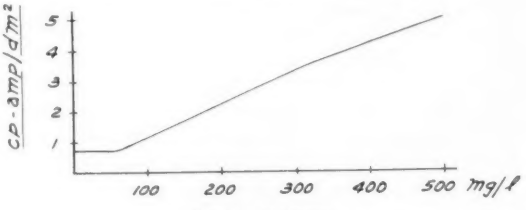


Fig. 9. Cadmium

c. 1. The curve in Fig. 9 shows that beyond 75 mg./l., the CP increases very rapidly. This curve greatly resembles that of zinc.

2. 70 mg./l. appears to be the maximum allowable concentration (z).

d. 1. Chelation by EDTA-Na_4 of 750 mg. of Cd per liter does not cause any improvement, since Cd chelation is hard to obtain at pH 3.5.

2. $Na_2S_2O_4$ affords a fairly decided improvement. The pits disappear, the evenness is better, but the dark area at low c.d. persists. This method, therefore, is only partially satisfactory.

3. Electrolysis at low c.d. remains the only completely effective way of eliminating this impurity.

MOLYBDENUM:

a. Molybdenum can result from the corrosion of the nickel-chromium-molybdenum steels (types 316 & 317) used in manufacturing certain pump and filter parts in contact with the nickel bath. Molybdenum was introduced into the stock bath as $Na_2MoO_4 \cdot 2H_2O$.

b. 1 & 2. Increasing the concentration of Mo up to 200 mg./l. first brought out a milky area at low c.d., and then no plate was obtained in that area as from 100 mg./l.

3. The maximum allowable concentration (x) is therefore estimated in the vicinity of 75 mg./l. for the appearance of the nickel plate.

4. The solubility limit was not reached.

c. 1. The curve in Fig. 10 shows that the CP of the chromium bath increases slowly up to 90 mg./l., and much more rapidly after that.

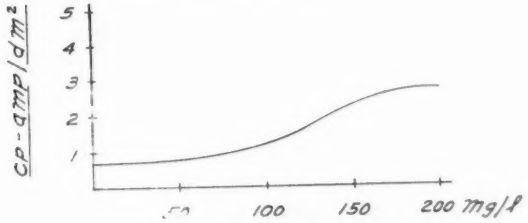


Fig. 10. Molybdenum

2. The maximum allowable concentration (z) is thus about 75 mg./l.

d. 1. Chelation by EDTA-Na_4 of 200 mg./l. has no effect.

2. However, hydrosulfite is very effective, since Mo is less harmful at valence III than at valence VI. The nickel plate is restored at low c.d., as well as its original appearance. The CP of the chromium bath is also improved. This is, consequently, a very satisfactory way of eliminating the impurity.

Conclusions

1. Except for chromium and, to a lesser degree, zinc, cadmium, and molybdenum, which give a very rapid rise of the covering power, most of the metallic impurities of bright nickel baths cause only a slight and gradual increase in the covering power of the chromium bath.

Fig. 11 combines the curves representing the variations of the chromium bath CP for each of the metallic impurities examined, as a function of their concentration in the nickel bath.

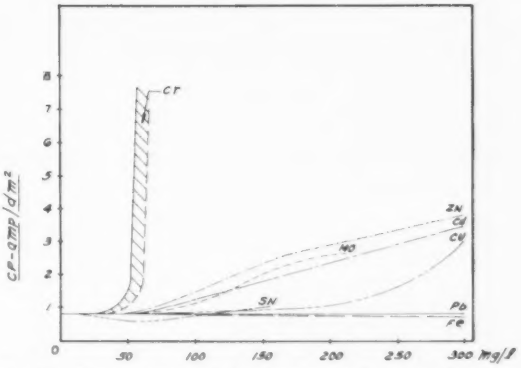


Fig. 11. Covering power of the chromium bath, for each metallic impurity, versus concentration in the nickel bath.

2. In the case of *all* metallic impurities, an alteration of the nickel plate appearance becomes noticeable before the concentration of the impurity causes any great change in the CP of the chromium bath (see Table).

3. Since the normal gradual contamination of a nickel bath by metallic impurities first affects the nickel deposit, we may draw the conclusion that:

When the CP of a well-balanced chromium bath increases considerably without any great change in the appearance of the nickel plate, then this change may be attributed to inorganic contamination of the nickel bath.

This situation can readily be checked by carrying out the two control tests described above.

4. For each metallic impurity there exists an effective method of removal which may be employed in the event of large-scale accidental contamination, (see Table).

5. The conventional methods of eliminating the more common impurities (by electrochemical displacement and electrolytic purification) remain the most effective in the case of normal and gradual contamination, provided however, that these methods are correctly applied (Appendix 1).

6. It is to be regretted that a quantitative analysis of the effects of organic impurities on the covering power of chromium bath has proven impossible at the present time. It seems to the authors that these impurities are not only the *basic* cause of the altera-

Impurity	Maximum Allowable Concentrations mg./l. (z) CP of chromium bath	(x) Appearance of nickel plate	Covering power & appearance	Removal
Copper	200	100	100	Displacement, electrolytic purification
Zinc	75	75	75	Electrolytic purification
Iron		no effect		Precipitates out automatically
Chromium	30	30	30	Reduction by $Na_2S_2O_4$
Lead	400	150	150	Reduction by $Na_2S_2O_4$
Tin	100	50	50	Precipitates out automatically
Cadmium	75	75	75	Electrolytic purification
Molybdenum	75	75	75	Reduction by $Na_2S_2O_4$

tion of the chromium bath CP, but also the most pernicious cause, since they are more difficult to detect through the appearance of the nickel plate.

Appendix 1

DISPLACEMENT:

We know that, when the deposition potential of ions M, which is:

$$E_m = E_o + \frac{0.059}{n} \log c$$

where E_o is the standard potential,
n is the valence, and
c the concentration of these ions,

is more electropositive than the equilibrium potential, E_n, assumed by an electrode of some metal, N, that is dipped into the solution, then this electrode will displace the M ions, which will be deposited on it. This is what happens in the case of even very low concentrations of copper in a nickel bath when the electrodes are of iron or nickel.

Unfortunately, when the electrode becomes covered by copper, it assumes the potential of a copper electrode and the displacement ceases. One way of continuing the purification is to apply a thin deposit of nickel, and interrupt the current in order to cause the displacement of copper by the electrodeposited nickel and so on. This operation is carried out by night in the tank itself by means of a timing device designed for this purpose.

The following characteristics are those of an installation that was set up by one of the authors:

Total cathode area for a 20,000-liter bath ..... 1200 dm.^{2}
Current density at beginning of cycle ..... 3.0 amp./dm.^{2}

1. Gradually raised from 3.0 to 3.5 amp./dm.^{2} in	1 min.
2. Nickel plating at 3.5 amp./dm.^{2} for	13 min.
3. C.D. gradually reduced from 3.5 to 3.0 amp./dm.^{2} in	1 min.
4. Current interrupted for	2 h. 45 min.
Total duration of cycle	3 hours

ELECTROLYTIC PURIFICATION:

For the other metallic impurities, an electrolytic purification must be performed at low current density. This electrolysis is sometimes called "selective" because the metal ions are deposited in the order of their deposition potentials.

The fact that a low mean current density (0.1 amp./dm.^{2}) is used is not sufficient; another requirement is that the cathodes have a shape such that they naturally provide areas of far lower current densities. Usually corrugated cathodes are used, but that shape is inadequate. The slope of the polarization curve increases and the c.d. decreases, which tends to improve the current distribution and compensate for the geometric form of the cathode. Thus, it is preferable to use obliquely set, flat cathodes which are sufficiently close to each other (Fig. 12), in order to provide very low local c.d.

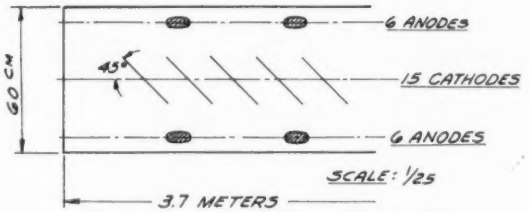


Fig. 12. Layout of cathodes for electrolytic purification.

The tank shown is one of the two connected separate tanks (2400 liters each), which are set up in series in the filtration circuit of the main tank. The characteristics of the cathodes are as follows:

Total surface (2 × 90 × 30 cm.)	54 dm.^{2}
Number	15
Slanting	45°
Spacing	20 cm.
Total current	75 amp.

This gives us a mean c.d. of approximately 0.09 amp./dm.^{2}.

Appendix 2

From the ideal standpoint, it would have been preferable to do as we had originally planned: nickel plate a flat cathode in a linear cell, so as to obtain an absolutely uniform nickel deposit over the entire cathode, and then bend this cathode before chromium plating.

However, there were two drawbacks to this method. When the impurities in the nickel bath are in sizable quantities, the brittle deposit becomes cracked at the angle where it is bent. Secondly, the handling makes it necessary to perform electrocleaning, hydrochloric dip, etc., before chromium plating — which inevitably cause alterations of the nickel plate.

It is for these reasons that we preferred to perform the nickel plating on a bent cathode, with a bisecting anode, although the current distribution could not be uniform. The primary distribution was determined by the conducting paper method (dotted curve in Fig. 2a) confirming the distribution given by Kasper.[3] The primary current distribution in the angle is zero, regardless of the anode-cathode distance but, due to the throwing power of the bath and the fillet radius at the apex, however, the secondary distribution (solid line in Fig. 2a) is improved and is sufficiently uniform for our purposes.

For the sake of completeness, it may be said that the secondary distribution is also improved in case 1b but to a negligible extent.

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Dipping and Flow Coating Methods

By J. Arthur Weed, *Consultant, Kirklyn, Pa.*

Dip Coating

MANY products that are of size and shape which permit good drainage will often prove to be more economical to dip or flow coat rather than spray paint. There are very stringent laws and other requirements covering the use of equipment of this sort, and the fire insurance company should be consulted before a decision is reached on the equipment that is being considered for the process.

When dip painting a product, it is necessary to completely immerse it in the paint tank. If it is carried through the tank by means of an overhead conveyor, the product will sometimes show a series of lines as it emerges from the tank. These marks are called finish stratification. Frequently they may be eliminated by the use of slower drying solvents which permit the paint to drain better and more evenly.

The condition of "fatty" edges, characterized by being blobs of coating material on the extreme bottom of the parts being dipped sometimes occur and, where this may be objectionable, it is often practical to use electrostatic detearing methods. This equipment will assist in drawing the excess material from the part.

When considering the use of dip painting methods, considerable thought must be given to: size and shape of the paint storage tank; type of pump and capacity (be sure that the pump has adequate capacity to keep the paint in constant circulation;) adequate automatic viscosity control; method of adding coating material as it is consumed.

Centrifugal Coating

A large variety of parts can be centrifugally coated economically. Parts are loaded into a work basket which is then either immersed in the coating material, or the paint is pumped into it. The coating is then evenly distributed by whirling the basket. In this manner the excess paint is removed and drained back to the storage area. By using a quick drying material it is sometimes possible to dry the parts during this spinning operation. There are many uses for installations of this type.

Another method of paint dipping that has received relatively little attention, but appears to have tremendous possibilities, is dip painting by means of controlled withdrawal. At one time such a machine received a good deal of publicity and, judging by the quality of coating produced by it, not unjustifiably so.

In this type operation the parts are usually suspended on a stationary rack. After the rack is completely loaded, the tank, containing the paint, rises to cover the parts. After the parts have been submerged in the paint, the tank starts to lower at a controlled withdrawal speed. In most cases the paint tank cannot be lowered at a faster rate than 12 to 18 inches per minute. In this manner the surface of the paint acts as a wiping medium and by means of surface tension removes the excess paint from the parts being dipped.

This method has been used for the painting of all sorts of difficult parts and, in most cases, the results obtained have been gratifying. The use of hydraulic cylinders for a source of power is ideal and these cylinders will permit the uniform motion which is so vitally necessary. By using two or more of these machines, a manufacturer of small parts can be more confident that he will maintain constant production, since one operator can be loading one machine while the other machine is in the process of completing its painting cycle.

Flow Coating

Where the shape or size of the product is such that extremely large tanks are required, it is sometimes more practical to consider the use of flow coating methods. This method of painting also requires that the product have excellent drainage but, in most cases, it is more suitable than complete immersion methods.

In flow coating the product is conveyed through an enclosed section. In this section paint is literally flowed over the product, so that it is thoroughly covered, by means of a series of nozzles spaced on centers. In most cases, the least troublesome type of nozzle has been sections of tubing that can be easily directed toward the required areas. Nozzles of this type are inexpensive and easy to maintain. The paint, which is supplied to these nozzles by means of a pump, then flows back to the paint tank or reservoir. After being conveyed through the flow coating section, the product is carried through a drain section where drain pans direct the flow of material back to the paint storage tank for re-use. The drain pans should be so constructed that they may easily be cleaned by flushing with solvent, and adjustable so that the paint or solvent may be drained back to the proper tank.

The selection of the proper type of pump to be used in a flow coating machine is of vital importance. It has been considered good practice to use a pump of somewhat larger capacity than needed. This, in effect, will permit the pump to deliver the necessary volume even when run at lower speeds than normal. Under certain conditions, lower speeds are desirable to reduce the possibility of excessive wear. This also applies to the service pump that is used for solvent make-up and cleaning purposes.

As with dip painting, it is imperative to have very close viscosity control. In many well designed installations, provision is made for either heating and/or cooling of the paint. Flat heat-exchange coils are excellent for this process and require a minimum of space. They are also easily removed when and if maintenance is necessary.

(*Continued on page 73*)

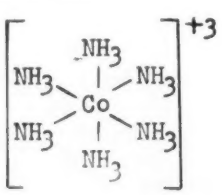
Science for Electroplaters

43. DIAMINES

By L. Serota

ETHYLENE diamine belongs to a class of organic compounds capable of forming complex or coordination compounds wherein one atom of a metal is attached or coordinated with four or six oppositely charged groups or neutral molecules, the entire stable unit acting as an ion in solution. Such compounds are often called "Werner Complexes," because the coordination theory of *A. Werner* provided a satisfactory explanation for the characteristics of such compounds. According to this theory, metals possess a primary or ionizable valence, designated as the principal valence, in which electrons are transferred; and a secondary, non-ionizable valence in a number of groups, known as the coordination number, which is shared by electrons or covalent links.

Secondary valences may be satisfied either by a negative group, in which sharing is attained as each atom provides an electron to form the shared pair (called normal covalence); or linkage may result with a neutral molecule, so that the link between the central atom and the neutral molecule is effected by one or more unshared pairs of electrons, (known as coordinate covalence). This latter form of electron sharing is commonly represented by an arrow pointed toward the atom forming the link. For example, the addition of an excess of ammonia to a solution of trivalent cobalt will form a compound with the complex cation cobalt hexamine $[Co(NH_3)_6]^{+3}$, coordination number 6, which gives none of the reactions of the cobalt ion. The coordinate covalent linkage may be represented as follows:



Each ammonia coordinate group in this structural arrangement contributes to the covalent link its lone pair of electrons.

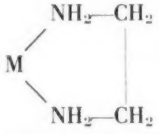
The metals from the transition element group, and those metals immediately following the transition elements, form the most stable complexes. *T. Moeller* lists the metals from which the principal complexes may be considered derived (Table 1).

TABLE 1

Cr	Mn	Fe	Co	Ni	Cu	Zn
Mo		Ru		Rh	Pd	Ag	Cd
W	Re	Os	Ir	Pt	Au	Hg

Chelation

Ethylene diamine, with two NH_2 groups, can occupy two coordination positions, instead of one coordination position as is the case with ammonia, NH_3. Such groups, in which two coordination positions can be occupied, are called bidentate or chelate (Greek = crab's claw) groups, with the unit forming a stable five member ring structure including the metal ion. This ring structure is referred to as a chelate ring. The general structure for the ethylene diamine 5 membered chelate ring may be represented as follows:

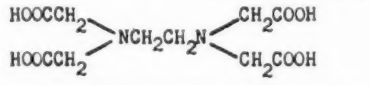


Of especial interest as a chelating agent, because of the stability of the non-ionic complexes formed with polyvalent metals, (as Cu^{++}, Co^{++}, Ni^{++}, Zn^{++}, Cd^{++}, Fe^{+++}, Al^{+++}, etc.) is the polyamino acid ethylenediamine tetra-acetic acid (abbreviated EDTA), with its sodium derivatives. *R. L. Tecosk* ascribes the stability of these complexes to the availability of four carboyl groups and two tertiary amine groups. These groups, including a metal ion, form the five membered ring, with the ethylenic linkage between the two nitrogen atoms contributing to the stability. The acid (EDTA) is very slightly soluble in water, as well as in the common organic solvents such as alcohol, acetone, etc. The solubility of the disodium salt is 10.8 g./100 ml. at 22°C., and 23.6 g./100 ml. at 80°C., whereas the tri and tetra sodium compounds are very soluble. An increase in pH occurs with an increase in the number of sodium replacements in the acid. The pH of EDTA is 2.8, with corresponding pH values of the di, tri, and tetra sodium salts 4.8, 8.8, and 10.5 respectively. The structural formulas for these chelating agents are shown in Table 2.

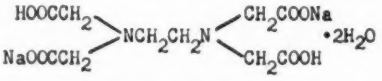
The disodium salt of EDTA is finding increasing application as an analytical reagent for the determination of metal ions in plating solutions and for the determination of hardness in water. The tetrasodium salt of EDTA is capable of complexing most metal ions, especially di- and trivalent metals, with noble metals the exception. A wide and expanding application for this chelating agent is thus provided for cleaning baths, immersion processes, and water softening, including removal of scale or metal impurities by preferential chelation. The equations representing two such reactions follow: $CuO + Na_2H_2X \rightarrow Na_2CuX + H_2O$; $Na_4X + CaSO_4 \rightarrow Na_2CaX + Na_2SO_4$. X represents the EDTA radical

The stability of these complex compounds is affected by the pH of the solution, with maximum chelating power and stability attained at high pH (high alkaline). For example, the

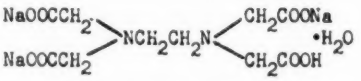
TABLE II. ***Various Forms of Chelating Agents.***



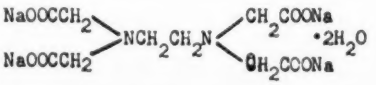
Ethylenediamine Tetraacetic Acid



Disodium - EDTA



Trisodium - EDTA



Tetrasodium - EDTA

effectiveness of the complexing action with calcium and magnesium ions is reduced when the pH is about 7.5 and, at a pH value below 5, precipitation of calcium as the oxalate cannot be prevented by the (EDTA) calcium complex. The extent of chelating power with respect to the calcium ion with variations in pH value is demonstrated in Fig. 180. In the case of the heavy

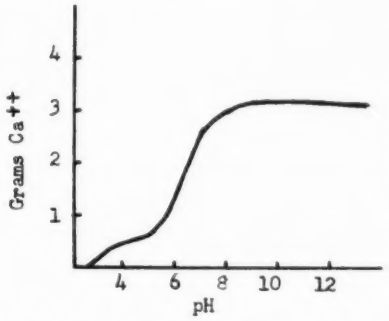


Fig. 180. Chelating Power as a Function of pH.

divalent metal copper, however, it is only complexed 50 per cent at a pH of 2, but 100 per cent chelation will result when the pH is increased to 3.5. Chelating power is stronger for divalent metals such as copper, cadmium, tin, zinc, nickel, etc., than it is for alkaline earths, such as calcium, magnesium, barium, and strontium. In most cases, chelation is most effective for the higher valence metals.

This property of preferential chelation, as shown by the formation of the copper complex at a lower pH than that of the calcium complex, is evidence of the relative stability of these complexes. The order of preferential chelation of metals at different pH values is represented in Table 3. The more strongly complexed metals are those shown at the left of each row of pH values. An added factor affecting the efficiency of a complexing agent is the presence of interfering ions such as

TABLE III. *Preferential Chelation of Metals at Several Values of pH.*

pH 4.00	Cr, Cu, Ni, Pb, Co
pH 6.50	Ni, Cu, Co, Zn & Cd, Ca
pH 8.65	Ni, Co, Cu, Zn & Cd, Ca, Mg, Sr, Ba
pH 11.00	Co, Ni, Cu, Zn & Cd, Ca, Mg, Sr, Ba

precipitating agents (anions), which tend to break down the complex and form a precipitate with the metal ion.

Chemically, EDTA will not decompose at high temperatures or in acid or alkaline solutions and will not be affected by reagents other than strong oxidizing agents, such as potassium permanganate or hot dichromates. Such reagents have the effect of changing the compound to a cyclic structure.

Metal Cleaning

The use of EDTA as an effective additive in alkaline cleaning baths for the removal of such corrosion products as insoluble metal oxides and hydroxides, as well as salts such as carbonates, sulfates, and phosphates, is discussed by *J. K. Aiken* and *C. Garnet*. Both simple immersion in hot concentrated EDTA and cathodic cleaning processes are described. The disodium salt of EDTA, because the solution is slightly acid (pH 4-5), is recommended as a satisfactory complexing agent for the removal from metal surfaces of mill scale and rust. The doubtful phase indicated for this procedure is the possibility of attack on the basic metal.

Removal of rust by alkaline EDTA cleaning solutions is not considered a satisfactory method for dissolving iron oxide or hydroxide. Two modifications are mentioned in which cyanide or a hydrolytic chelating agent is combined with EDTA in a strongly alkaline bath. Either method is considered effective for dissolving ferric hydroxide. The cyanide bath modification, which attacks mill scale and rust, is used in the U. S. Government Rock Island Arsenal. The second procedure, which includes a hydrolytic chelating agent, a patented decorrosion process, is used in England for derusting only. The advantage indicated for this method is regeneration of the bath by plating out the chelated iron at intervals. The solution is prepared with alkaline sodium salts, chelating agents and a non-ionic wetting agent. A current density (2-10 V.) of 30 amp./ft.^{2} and upward was applied at a bath temperature of 100°F. The tank serves as one of the electrodes and the object to be cleaned as the other electrode. Periodic reverse current seemed to speed up the rust removal as well as reducing hydrogen embrittlement. Increasing the temperature to 200°F. reduced operating time to 15 minutes.

The absence of cyanide or heat sensitive compounds eliminates the need of a separate cooling system in the continuous cycle, overcomes the effluent problem associated with cyanide baths, extends the useful period of the bath, since the reagents do not hydrolyze, and simplifies the ventilation problem by eliminating poisonous fumes.

Other Applications

Several applications of chelating agents in plating processes are mentioned by *H. Narcus*. With properly controlled conditions, copper may be removed as an impurity in a gold cyanide solution, by forming the copper complex before the gold complex is feasible, since gold, a noble metal, would be chelated only slightly, if at all. Another reference concerns the use of chelating agents in anodizing, as a method of counteracting the effect of dissolved metallic ions (traces) such as calcium, magnesium, iron, copper, tin, etc. on dye shades. Without such an agent, streaking, spotting, dullness, poor color yields, and serious color changes are possible. Metal ions may be introduced in the bath from corrosion of fittings and dye tanks, rusting and scaling of water pipes and overhead structures, or the calcium and magnesium salts common to hard water.

In an effort to obviate precipitating and redissolving the metal in acid as a means of purifying a rhodium plating solution, the use of EDTA as a complexing agent for metal impurities in a rhodium bath was reported by *E. A. Parker*. Precipitation of rhodium is not a desirable method because it is incomplete and the cost of the metal is relatively high.

The chelating agent was added to different rhodium solutions containing respectively the following metal contaminants: copper, silver, tin, lead, cadmium, nickel. It was found that, with the exception of the copper, with the addition of 1.1 grams per gallon plate characteristics for the test sample showed improvement; when 2 grams per gallon were added to each sample further improvement resulted in all cases. Deposits from the nickel and tin contaminated solutions were bright and somewhat dark without evidence of streaks, grayness, or haze. The cadmium solution gave good results, but the lead contaminated solution required 2.65 grams EDTA for a bright, dark plate, and the silver contaminated solution showed a semi-bright plating range. Complexing of rhodium with EDTA seemingly does not occur. Current efficiency, however, showed an appreciable drop when the concentration of EDTA was greater than 2.0 grams per gallon.

As was previously mentioned, an equilibrium exists between the metallic complex (chelate) and the free (non-

chelated) metallic ion with a very high stability constant value. The corresponding exceedingly low concentration of metallic ions, however, may be displaced in solution by a metal higher in the electromotive series. The deposition of copper on iron and steel from an EDTA copper chelate solution has been developed. The process produces high quality immersion deposits which are bright, continuous, dense, and very adherent. The toxicity of the bath is very low so that handling or disposal of the used solution is relatively simple. The increasing concentration of iron in the bath as the result of displacement will, after a while, affect the quality of the copper plate. Purification is considered very impractical. The following formula is recommended: copper sulfate crystals 5 oz./gal.; EDTA dry powder 13 oz./gal.; wetting agent 0.07 oz./gal.; pH (adjusted with H_2SO_4) 4-5; Temperature 104-140°F.); immersion time 1-5 minutes; copper thickness 0.02-0.03 mils.

Analysis

The development of analytical methods, using EDTA, gained impetus following the report by *W. Biederman* and *J. Schwartzenback* that Eriochrome Black T is suitable as an indicator with EDTA for the "complexometric" titration of alkaline earths, as well as some other actions such as zinc and cadmium. The importance of EDTA as an analytical reagent was emphasized by *J. D. Leftin* when he expressed the view that a rapid and inexpensive method is especially desirable for analysis of plating solutions, since the relatively wide variation in permissible concentration of the constituents of a plating bath obviates the accuracy usually associated with chemical analysis. For plating solution analyses, accordingly, an accuracy within a range of 5 to 10 per cent is considered sufficient in most cases.

The dye Eriochrome Black T, when in solution (pH 8-10), has a blue color. In the presence of some metal ions such as Ca, Mg, Zn, Cd, the color changes to a deep wine-red owing to the formation of a chelate complex of the metal ion and the dye. When EDTA is added to a solution containing a small quantity of the dye and a metal ion, such as magnesium, the wine red colored complex is broken down and the stronger chelation of the metal ion with EDTA results. The effect produced by this change is a return of the blue color of the dye. The calcium complex is not very stable compared to magnesium, so that the dye is of little value as an indicator for calcium. In an earlier report Biederman and Schwartzenback described the use of murexide (ammonium purpureate) as a good indicator in the presence of the calcium ion, with the color changing in alkaline solution from salmon-pink in the presence of the calcium ion to blue-violet, the color of the purpureate ion, when the calcium is complexed. This dye is also suitable as an indicator for Zn, Cd, Hg, Cu, but not for magnesium.

J. A. Head and associates discussed a method for determining total hardness (calcium and magnesium) of water. The calcium ion is preferentially complexed during titration with the disodium salt of EDTA, buffered with ammonium chloride and ammonia. Since calcium does not form a stable complex with Eriochrome Black T, a good end point is not attained until magnesium has been chelated with EDTA. The wine red color of the magnesium Eriochrome Black T chelate disappears at the equivalence point, and the solution turns blue. The color change is sharp and clear.

A rapid method for determining magnesium in nickel (barrel) plating solutions by titration with the disodium salt of EDTA and Eriochrome Black T as an indicator was reported by *K. E. Langford*. The value of the salt in nickel plating solutions has been known, but its wider application, the author contends, has been retarded because the methods of analysis heretofore employed for determining magnesium required about 24 hours. Such benefits in nickel barrel plating as increase in conductivity and throwing power, repression of nickel ion concentration by the common ion effect, and a whiter deposit are indicated for this salt. Solutions used for plating on aluminum contain concentrations of magnesium sulfate up to 1 lb./gal. The solution to be titrated is buffered with ammonium chloride and ammonium hydroxide. Interference by the nickel ion is eliminated by adding sodium cyanide as a complexing agent. Interfering ions include aluminum, trivalent chromium and manganese. Langford notes, however, that these ions are not usually present in sufficient quantities in normal plating solutions to have any effect on the results of this analysis.

Langford also investigated the adaptability of the complexometric (EDTA) method of analysis for the determination of nickel as a replacement for the cyanide/silver nitrate titration, gravimetric and electrolytic methods. The second indicator found suitable for the titration with EDTA, namely, murexide (ammonium purpureate) gives a reddish brown color to a solution (pH 12) in the presence of the nickel as well as the calcium ions. The indicator changes to violet-blue after complexation of the ion with EDTA. Since a sodium hydroxide solution cannot be used because of the formation of insoluble nickel hydroxide at a high pH, an ammoniacal solution was used, giving a sharp color when the nickel was completely complexed. The presence of large amounts of ammonium chloride or sulfate caused poor end point due, it was believed, to a lowering of the pOH resulting from the common-ion effect.

Cobalt, if present, will complex with EDTA and give an end point similar to nickel, so that titration results will represent the combined cobalt-nickel concentration. Elimination of this interfering ion can be accomplished by oxidation of cobalt (with ammonium persulfate) in the alkaline solution. The cobalt amine complex, $Co(NH_3)_6$, which will form, will not react with the EDTA during titration.

Magnesium ion, if present as an additive, will also interfere with the titration and must be removed. The low concentration of magnesium which may be present in tanks, owing to depassive anodes, will not affect the results. Magnesium is removed by precipitation. The reagent ammonium phosphate is added at the boiling point and the solution is then cooled to reduce coprecipitation. The end point, however, is not as sharp as it is with titrations in which nickel salts only are present. The method, accordingly, is not recommended if magnesium ions are present.

Further application of the EDTA method of analysis includes determination of zinc and cadmium in cyanide plating solutions, lead in lead fluoborate solutions, and copper in acid copper and copper cyanide-Rochelle salt solutions. *F. W. Gutman* reported favorable results for the determination of copper by titrating a prepared copper solution with .05 molar disodium EDTA. Determination of copper in a copper-cyanide-Rochelle salt solution by this complexometric method was reported by *C. E. Gehrand*. Results of a titration of a prepared copper cyanide Rochelle solution were in close agreement with the actual concentration.

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cleaning Stainless Steel

Question: Our problem is that in the course of manufacture of stainless steel flatware which we have just started, we find that a degreasing operation is necessary and we use trichlorethylene, after polishing. This still leaves a faint bloom on the articles and we have found no other way of removing this except by wiping the articles with clean rags.

L. R. C.

Answer: The bloom resulting from degreasing of buffed stainless steel is due to a residue of abrasive, since the degreasing solvent removes only the grease binders. Better results would be obtained by use of sprays or by soaking in an agitated emulsion type cleaner.

Fumes from Copper Tank

Question: Will you please advise your opinion of the toxic effect of operating a cyanide copper plating tank with a surface area of 16 square feet, at room temperature.

This tank is operated in an open room with twelve foot ceiling, three doors, three windows, and a louvered skylight, all of which are permanently open. Further, it is operated only for a flash copper cycle of approximately ten seconds duration, very intermittently (approximately 8 to 10 times per 8-hour day).

J. B.

Answer: Tests in the past have shown the absence of harmful concentrations of cyanide in the atmosphere at face levels above cyanide plating solutions during operation, unless there is excessive gassing. However, many State Labor Departments require local exhaust ventilation by means of enclosing hoods, overhead canopies, or lateral exhaust hoods on all cyanide tanks used for electroplating, except silver and gold.

If you feel your operation does not produce any fumes, orders of the local inspector can be appealed and a "variation" of the order requested from the appeals board. The usual procedure in such cases is to analyze air samples in order for the department to determine the validity of the claim.

Lead Sulfamate

Question: We have been trying unsuccessfully to find a vendor of the lead sulfamate plating solutions as described in proprietary technical literature from a supplier who no longer makes lead sulfamate.

I thought that METAL FINISHING might have a list of suppliers of the various chemicals used in plating and possibly could suggest a supplier for this salt, if one exists.

E. V. R.

Answer: We do not know of any vendors of lead sulfamate. However, the salt can be prepared readily by dissolving basic lead carbonate in sulfamic acid solution. Any lead sulfate formed will precipitate and the clear solution of lead sulfamate can be decanted off, or filtered.

Dull Finish on Aluminum

Question: Enclosed is a sample of a mat finish on aluminum. We are told it is a "brushed" finish and would like to find someone who can tell us how it is done and the equipment necessary to do it. We know of chemicals to produce this finish but want to produce it on sheet aluminum mechanically.

Any help you can give us will be appreciated.

D. M.

Answer: The finish on the aluminum sheet forwarded is not brushed on the dull side. It can be duplicated by vapor blasting or, during the rolling operation, by using one etched or abrasive blasted and one polished roll.

Vapor blasting equipment is offered by most manufacturers of sand blasting units.

Gold Testing

Question: I am in need of technical information on polysulfide testing of gold plating. I would greatly appreciate any source of information on this test.

T. P.

Answer: We are not aware of any polysulfide test for gold. Usually, the porosity of gold deposits is tested by applying a drop of 50% by volume nitric acid solution and the time noted for reaction to begin.

A polysulfide test would probably be suitable for flash gold deposits on copper alloys. However, it would not react on articles which have a nickel undercoat, as does the nitric acid test.

A polysulfide test employed for lacquered surfaces consists of immersion for 3 minutes at 100° F. in a solution of 1 oz. Liver of Sulfur and 49 oz. water. The part is warm rinsed and then cold, followed by wiping until dry. After standing at room temperature for 1 hour, there should be no more than one or two dark spots per square inch and they should be not more than $\frac{1}{32}$" in diameter. A slight yellowing is not considered failure.

Hot Galvanizing Nails

Question: We have been asked to do galvanizing (hot dipped) on steel nails (1¼" to 3" long), but we do not know much about that process. Will you be in a position to give us the information step by step?

N. J.

Answer: The steps in hot-dip galvanizing consist of cleaning to remove grease and oil, rinsing, pickling to remove rust and scale, rinsing, fluxing in zinc-ammonium chloride, hot-dip-

ping, centrifuging in the case of small parts such as nails, and quenching.

Special equipment is available for dipping and centrifuging small parts and we would suggest you communicate with the American Zinc Institute, Inc., at 60 E. 42nd St., New York 17, N. Y., for information on the process.

Finishing Bronze Plaques

Question: Our process for finishing bronze memorial plaques is to first sandpaper all parts that later will be polished, next the plaque is sand-blasted, then dipped into water mixed with sulfurated potash. When dry we polish the letters and the border and give the plaque three coats of clear metal lacquer.

These plaques are out in the weather and within a year or so they turn black. When placed interior, however, they remain beautiful for a long time. We have noticed on plaques made by some foundries what seems to be a lacquer paint of some type that does many jobs at once. For instance, it gives the plaque a color very close to that of oxidation, it fills every small pin-hole a plaque may have to the point where you have to look very closely to see them, and also these plaques remain the same color for many years even though they are out in the weather.

Something of this type is what we would like to have. However, even if you could just give us a type lacquer or method that would hold up in the weather we would be most appreciative.

S. S. L.

Answer: Lacquered bronze plaque should not turn black within one year unless you are using a lacquer which has not been formulated for outdoor exposure. We would suggest that you check with your lacquer supplier.

Instead of using a sulfide finish for the background, a similar effect can be obtained by application of burnt umber prior to lacquering. Plaques are also finished by waxing instead of lacquering when outdoor use is anticipated and the item is cleaned and polished regularly.

Basement Baking Ovens

Question: What are the regulations regarding paint baking ovens located in basements?

J. D.

Answer: Ovens, as a general rule, should not be located in closely confined or restricting areas. Since basements offer obstacles to providing proper oven explosion release, severe damage has resulted to upper stories of buildings having them so located. Class A ovens should be located at or above grade. When in basements, at least fifty percent of the wall area of the room where they are located should be above grade.

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Chromium Removal from Plating Baths

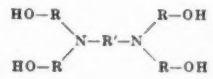
U. S. Patent 2,833,703. *May* 6, 1958. *E. Lane, assignor to MacDermid, Inc.*

A process for removing trivalent chromium contaminants from a metal cyanide plating bath, which comprises adding thereto a substituted anthraquinone capable of forming a chromium lake therein selected from the group consisting of 1,2-dihydroxy anthraquinone, ring substituted 1,2-dihydroxy anthraquinones and mixtures thereof, contacting the thus treated bath with activated carbon and then separating the carbon, chromium lake and adsorbed substituted anthraquinone from the bath.

Cadmium Plating

U. S. Patent 2,833,705. *May* 6, 1958. *J. B. Winters.*

A cadmium cyanide plating bath composition containing a totally hydroxyalkylated alkylene diamine having the formula



in which each R and R′ is an alkyl radical containing from 2 to 4 carbon atoms, in a concentration of about 0.1 to about 1 gram per liter.

Electroplating Apparatus

U. S. Patent 2,833,708. *May* 6, 1958. *M. B. Hammond and G. B. Bowman, assignors to Rockwell Spring and Axle Co.*

Apparatus for electroplating a three-dimensional article having convex surfaces.

Anode Hook Sleeve

U. S. Patent 2,833,710. *May* 6, 1958. *D. Mielke.*

An electrode structure comprising an elongated electrode body, a support hook detachably secured at one end of said body, an elastic sleeve tightly engaging a portion of said hook, said sleeve having a skirt portion defined by a laterally extending portion with a depending peripheral portion tightly engaging the upper end of said electrode, the wall thickness of the entire skirt portion being uniform and substantially less than the wall thickness of the remainder of said sleeve.

Hose-Type Paint Heater

U. S. Patent 2,833,909. *May* 6, 1958. *G. S. Levey.*

A heat exchanger comprising an elongated flexible conduit, a flexible electrical heating element in the said conduit and extending throughout the length thereof, an electrical circuit for said heating element, a perforate body of heat conductive material having a passageway for fluid to be heated, said passageway being connected to the inlet of said conduit, a heating element in said body connected to a source of electrical energy, and a thermostatic switch in said body actuated by the temperature of the fluid in the passageway in the body whereby the introduction of cold fluid into said passageway immediately closes the circuit to the heating element in said conduit and the interruption of the flow through the conduit allows the heating element in said body to raise the temperature of the fluid adjacent said thermostatic switch and open the circuit to the heating element in said conduit.

Gas Plating

U. S. Patent 2,834,690. *May* 13, 1958. *P. R. Marvin, assignor to The Commonwealth Engineering Co. of Ohio*

A method of producing integral metal shapes by gas plating which consists in the steps of providing a shape from cellulosic material which is combustible at a relatively low temperature, applying a coating film thereover which is heat conductive, heating the resultant coated-shape under reduced atmospheric pressure conditions to a temperature to cause a gaseous metal compound brought into contact therewith to be decomposed, contacting the heated coated-shape with a gaseous metal compound which decomposes depositing the metal constituent as a coating thereon, and continuing the deposition of metal to build up a relatively thick coating of metal, and then burning away the cellulosic material to provide a completed metal shape.

Chemical Polishing of Metals

U. S. Patent 2,834,659. *May* 13, 1958. *O. B. Mathre and D. M. Sowards, assignors to E. I. du Pont de Nemours and Co.*

The process of polishing a metal surface which comprises contacting the same at a temperature of 100°C. to 110°C. with a solution containing 0.5 to 3% monoperphosphoric acid, 73% to 79% phosphoric acid, and 20% to 23% water.

Paint Base Production

U. S. Patent 2,834,691. *May* 13, 1958. *W. B. Stephenson, Jr. and D. H. Greisl, assignors to General Electric Co.*

A method of preparing iron or an iron base metal article to produce a bonding film for subsequent coating comprising the steps of: treating the article with an aqueous solution including about 6-9% by weight hydrated sodium sulfate and about 6-11% by weight hydrochloric acid solution having a concentration of about 37% by weight of hydrogen chloride until a soft bonding film is produced on the surface of the article; rinsing the article; and then heating the article to about 400-440°F. to convert the soft bonding film to a hard and adherent form.

Plating Printed Circuits

U. S. Patent 2,834,723. *May* 13, 1958. *J. C. Robinson, assignor to Northern Engraving & Mfg. Co.*

The method of electro-plating the conducting elements of a multi-part printed circuit formed on the face of a non-conducting base, comprising the steps of: masking a fragmentary portion of each conducting element while leaving a fragment of each element exposed along the margin of the masked portion; covering the entire face with a removable electrically conducting coating; applying an electrically non-conducting coating over the electrically conducting coating; removing the first mask and the coatings thereon to expose the masked portion and define a unitary conducting area including the electrically conducting coating and the conducting elements of the printed circuit; electro-plating onto the face using

the said conducting area as one electrode; and removing the remaining portions of the coatings to restore the original circuit configuration.

Plating on Plastics

U. S. Patent 2,834,724. *May* 13, 1958. *A. P. Mendes.*

A method of coating a plastic article with a noble metal, which comprises the steps of forming on said plastic article in a vapor vacuum chamber a thin film base of a metal selected from the group consisting of antimony, bismuth and arsenic, and then coating said article with the noble metal by electrodeposition.

Cobalt-Nickel Alloy Bath

U. S. Patent 2,834,725. *May* 13, 1958. *H. C. Scheer and E. R. York, assignors to International Business Machines Corp.*

An electroplating solution for depositing a coating of an alloy consisting of cobalt and nickel, which consists of a water solution containing chlorides of cobalt and nickel, boric acid, and a thiocyanate from the class consisting of sodium, potassium and ammonium thiocyanates, the amount of thiocyanate ranging from 5×10^{-4} to 5×10^{-3} grams per liter.

Belt Sanding Machine

U. S. Patent 2,835,083. *May* 20, 1958. *G. De Mambro and L. G. Brown, assignors to The Carborundum Co.*

A belt sander comprising a base, a pair of spindles mounted on said base, a pair of pulleys mounted on said spindles, respectively, for rotation about their longitudinal axes, said longitudinal axes lying in one plane, means for rotating one of said pulleys and an endless backup belt mounted to travel around said pulleys.

Corrosion Preventive

U. S. Patent 2,835,599. *May* 20, 1958. *R. R. Snyder, assignor to The Texas Co.*

A corrosion inhibiting composition for application to metal surfaces consisting essentially of 5-17% comminuted hydratable mineral cement selected from the group consisting of Portland cement and clay-mortar cement and 79-95% petrolatum base compound, by weight; said petroleum base compound consisting essentially of 20-30% light petroleum solvent 40-53% petrolatum, and 15-30% lubricating oil, all by volume.

Oxalate Conversion Coatings

U. S. Patent 2,835,616. *May* 20, 1958. *W. Rausch and F. Gonnert, assignors to Parker Rust Proof Co.*

A method of producing oxalate coating on stainless steels, which coatings greatly improve metal-drawing operations, which method comprises subjecting the surface of the metal to a series of treatments in the order: (1) an acid-pickling treatment to remove corrosion and scale, (2) an alkaline rinse in a solution containing from 5 to 25% of an alkali-metal hydroxide and from 0.02 to 1% of an activating ion selected from the class consisting of cyanide and thiocyanate, and (3) contacting the resulting acid-pickled, alkaline-rinsed metal surface with an oxalate coating solution until a uniform and tightly-adherent coating is formed thereon.

Phosphate Conversion Coatings

U. S. Patent 2,835,617. *May* 20, 1958. *J. I. Maurer, assignor to Parker Rust Proof Co.*

An aqueous solution for coating a continuous hot-dipped, zinc-coated ferrous surface comprising as the essential coating-producing ingredients about 0.5% to 2.5% phosphate ion, a metal ion of the group consisting of the zinc ion and the manganese ion in a proportion at least sufficient to form dihydrogen phosphate with said phosphate ion, 0.01 to 0.4% nickel ion, at least one oxidizing ion from the group consisting of the nitrate ion and the nitrite ion in a concentration of about 0.2 to 1% nitrate ion and 0.0002% to 0.008% nitrite ion, and a silicon-containing ion in a proportion sufficient to produce at least 0.03% soluble silicon.

Plating Barrel

U. S. Patent 2,835,664. *May* 20, 1958. *W. E. Belke, assignor to Belke Mfg. Co.*

An electroplating barrel assembly adapted to improve plating quality and reduce plating time and cost by double oscillating action by moving the work parts up and down and back and forth and around the contacts.

Preparation for Plating

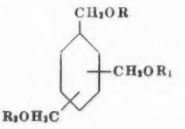
U. S. Patent 2,835,630. *May* 20, 1958. *R. A. U. Huddle and O. Flint, assignors to the United States of America*

A method of treating the surface of a metal of the group consisting of uranium, zirconium, titanium, tantalum, niobium, molybdenum, tungsten and vanadium which consists in the steps of subjecting the surface to shot blasting using ferrous metal shot, coating the shot-blasted surface with copper, and electrodepositing upon the copper a protective metal.

Corrosion Preventive

U. S. Patent 2,835,635. *May* 20, 1958. *R. L. Mayhew and C. F. Jelinek, assignors to General Aniline & Film Corp.*

A corrosion inhibiting composition comprising a major proportion of a liquid hydrocarbon having a boiling point of 50° to 500°C. and a corrosion inhibiting amount of at least one ester of tris-hydroxymethylbenzene having the following general formula:



where in R, R_1 and R_2 are selected from the group consisting of hydrogen and acyl groups containing from 5 to 40 carbon atoms, and wherein at least one of the R's is an acyl group.

Adjustable Paint Brush

U. S. Patent 2,835,913. *May* 27, 1958. *S. Di Giacomo*

An adjustable brush comprising a handle having a relatively long narrow handle portion and a relatively wide head portion.

Roller Brush Splash Guard

U. S. Patent 2,835,915. *May* 27, 1958. *O. Pearson, assignor to V. C. Hermstad*

A splash guard for a roller paint brush of the type having an elongated rearward handle substantially normal to the axis of the roller element.

Paint and Lacquer Dispenser

U. S. Patent 2,836,331. *May* 27, 1958. *P. A. O'Neill, assignor to Union Machine Co.*

A container cover having an exterior portion; said cover having a valve seat on the exterior portion and a port that opens in said seat; a closure member slidable on said seat between open and closed positions; a manually operable lever supported on the cover and carrying said closure member; said cover having a vent opening; a movable closure on the exterior portion of the cover cooperating with the vent opening; and a link connecting the lever and the vent closure for opening the vent when the port is opened.

Red Lead Composition

U. S. Patent 2,836,483. *May* 27, 1958. *W. E. Schulz, assignor to E. I. du Pont de Nemours and Co.*

A red lead composition of improved flowing properties consisting essentially of red lead and a thiuram disulfide-stabilized chloroprene polymer obtained by polymerization at 10°C. in an aqueous emulsion in the presence of an aliphatic mercaptan, said chloroprene polymer being present in the amount of 0.2-1.0% by weight based on the red lead.

Plating Barrel

U. S. Patent 2,836,400. *May* 27, 1958. *W. H. Jackson, assignor to The Udylite Corp.*

In an electroplating cylinder a pair of spaced end walls, a pair of circumferentially spaced external spacer members extending between and secured at their ends to said end walls, a pair of elongated securing members each removably fastened to a different one of said spacer members and disposed exteriorly of said cylinder, said securing members being shaped to conform to surfaces of said spacer members, a unitary perforated membrane extending circumferentially from one of said spacer members to the other one thereof and having its ends secured between said spacer members and said securing members, a plurality of corner supports circumferentially spaced around said cylinder between said spacer members, each one of said corner supports including an outer member disposed exteriorly of said cylinder and extending between and secured to said cylinder and removably secured to said outer member, said membrane extending between the inner and outer members of each one of said corner supports and being retained thereby in a predetermined position.

Corrosion Preventive

U. S. Patent 2,836,499. *May* 27, 1958. *J. F. Lyons, assignor to The Texas Co.*

A rust inhibiting coating composition characterized by the ability to prevent rusting of areas on salt quenched steel articles which are encrusted with residual salt, said composition consisting essentially of 44-58% by weight of light volatile petroleum solvent, the balance being a mixture of a rust inhibiting compound, petrolatum and soluble oil, said mixture consisting essentially of a corrosion inhibiting amount up to 3% by weight of at least one rust inhibiting compound selected from the group consisting of butyl stearate, aluminum stearate and sodium chromate decahydrate, 27-39% by weight of petrolatum and 60-72% by weight of a soluble oil, said soluble oil having as essential components 60-75% by weight of lubricating oil, 14-18% by weight of sodium sulfonate derived from treating mineral lubricating oil with sulfuric acid and caustic soda, rosin soap derived from treating with caustic soda 3-5% by weight of gum rosin based on said soluble oil, sodium naphthenate derived from treating with caustic soda 6-8% by weight of naphthenic acid based on said soluble oil and an effective amount up to about 1% by weight of ethylene glycol monobutyl ether.

Electroless Nickel

U. S. Patent 2,836,510. *May* 27, 1958. *E. L. Bolin, assignor to General Motors Corp.*

A process for plating nickel on a metal article which comprises the steps of providing an aqueous chemical reduction plating bath comprising 5 to 50 grams per liter of a soluble nickel salt, 5 to 100 grams per liter of a hypophosphite reducing agent, 15 to 100 grams per liter of a compound selected from the group consisting of glycollic acid, lactic acid, and acetic acid and .01 to .05 gram per liter of a material selected from the group consisting of glue and gelatin, adjusting the pH of said bath to within the range of 3 to 6.5 heating said bath to a temperature within the range of about 170°F. to 200°F., and while said bath is maintained at a temperature within this range, immersing the metal article to be plated in the bath until the desired thickness of nickel plate is deposited thereon, and thereafter subjecting the plated article to a heat treatment at a temperature within the range of about 350°F. to 800°F. for a time of at least one hour to improve the ductility and corrosion resistance of the nickel plate.

Chromizing

U. S. Patent 2,836,513. *May* 27, 1958. *G. A. Samuel, assignor to Metal Diffusions, Inc.*

The method of chromizing ferrous metal articles, which comprises coating the articles with a watery disperson of chromium, the complex fluoride of ammonium and chromium and an inert bodying agent, to form an adhesive bonded chromizing layer on the ferrous metal articles, and heating the ferrous metal articles to a temperature of 1600 to 2200 degrees F. and maintaining the articles in a closed space at that temperature while exposed to and protected by the gas atmosphere evolved from the complex fluoride to diffuse chromium into the articles and render the coating friable so that it can be easily removed.

Immersion Gold

U. S. Patent 2,836,515. *May* 27, 1958. *F. X. McNally, assignor to Westinghouse Electric Corp.*

In the method of depositing a gold coating on a metallic member having a silver surface, without the use of externally applied electrical current, the steps comprising immersing the member in a solution comprising a mixture of gold chloride and water, with an acid present in an amount sufficient to maintain the pH of the solution at about 1.0 to 0.3, the acid being selected from the group consisting of hydrochloric and sulfuric acids, and removing the member from the solution after a period of time of at least one minute whereby gold is immersion plated on the silver surface.

Coating for Aluminum

U. S. Patent 2,836,526. *May* 27, 1958. *M. N. Marosi.*

The process of coating aluminum products with a thin layer of adhering material formed by the chemical action upon aluminum oxide of a formulated water solution of sulfuric acid, citric acid, sodium acid fluoride and an anionic type wetting agent in the approximate effective ratio of 1:1:.33:.05 respectively.

Plating on Uranium

U. S. Patent 2,836,548. *May* 27, 1958. *A. G. Gray and E. W. Schweikher, assignors to the United States of America.*

The method of preparing metallic uranium for electroplating, which comprises treating the surface of the uranium for about one minute in aqueous 40% to 55% nitric acid solution to remove foreign material and expose a clean metal surface, treating the cleaned surface with aqueous 30% to 40% hydrochloric acid until it is etched black, promptly withdrawing it from the hydrochloric acid and treating it with aqueous 40% to 55% nitric acid for a

few seconds to remove the black coloration and provide a gray etched metal surface.

Nickel Plating Bath

U. S. Patent 2,836,549. *May* 27, 1958. *F. I. Nobel and B. D. Ostrow, assignors to Elechem Corp.*

In a nickel plating bath comprising an aqueous solution of a compound taken from the class consisting of nickel sulfate and nickel chloride, the improvement which comprises the addition of the reaction product of a soluble acetylenic compound having from 2 to 15 carbon atoms and taken from the class consisting of acetylenic halides and acetylenic alcohol halides, with an alkylene polyamine having 2 to 12 amino groups, the alkylene groups having 2 to 3 carbon atoms, said soluble acetylenic compound being present in an amount of from .001 g./l. to 1.0 g./l., said product containing at least one carbon-to-carbon triple bond and being an acetylenic polyamine.

Plating on Aluminum

U. S. Patent 2,836,550. *May* 27, 1958. *W. D. MacLean, assignor to Chemical Research Corp.*

The method of electrodepositing chromium directly upon a metal selected from the group consisting of aluminum and aluminum base alloy products to deposit a continuous, consistent, highly ductile and easily buffed plate and one that remains crack free upon bending of the finished products; which comprises providing an electrolytic bath consisting essentially of chromic acid and the sulphate radical, immersing the articles to be plated in said aqueous solution of chromic acid and the sulphate radical, electrolyzing the solution under a current density of 0.4 to 0.9 ampere per square inch of surface to be plated and maintaining said solution at a maximum temperature not over 50°F. through controlled cooling means and throughout the entire cycle used to chromium plate said aluminum and aluminum base alloy products.

Activating Nickel Surfaces

U. S. Patent 2,836,552. *May* 27, 1958. *J. D. Patrick, assignor to General Motors Corp.*

A method of activating a surface of nickel for the electrodeposition of chromium thereon which comprises providing an aqueous solution consisting essentially of chromic acid within the range of 2 to 6 ounces per gallon and sulfate within the range of .05 to .30 ounce per gallon, immersing the nickel in said solution, said solution being at a temperature within the range of about 60° to 160°F., and passing an electric current through said solution with the nickel as the cathode at a current density of about 2 to 12 amperes per square foot for a time within the range of about 30 seconds to three minutes.

Paint Roller

U. S. Patent 2,836,840. *June* 3, 1958. *W. J. Pratt.*

Paint roller means for edging comprising a handle shaft having a bend therein, a frusto-conical roller freely mounted for rotation with its base adjacent one end of said shaft, a guide member fixedly connected to said one end of said shaft at an angle to the base of said roller, and a handle member freely mounted on said shaft.

Mask Washing Machine

U. S. Patent 2,837,100. *June* 3, 1958. *R. B. Way and C. D. Hersey.*

A mask washing machine comprising a frame, a container rotatably mounted on said frame, means to rotate said container, a cover for said container, said cover supported on said frame, and means on said cover to support articles to be washed, said cover being movable upward off of said container to an unloading position and movable into engagement with said container lowering articles supported thereon into said container.

Corrosion Inhibitor

U. S. Patent 2,837,432. *June* 3, 1958. *S. W. Drigot, J. M. Lebolt, L. I. Minow, and A. H. Reynolds, assignors to The Cromwell Paper Co.*

A method of controlling the dissipation of a volatile corrosion inhibitor into its vapor-state which comprises dispersing said volatile corrosion inhibitor in a water-soluble wax, whereby, as the wax sloughs at a rate determined by the humidity of the surrounding atmosphere, new surfaces of wax and inhibitor are successively exposed, from which surfaces the inhibitor vaporizes into the surrounding atmosphere.

Mildew Resistant Paint Composition

U. S. Patent 2,837,433. *June* 3, 1958. *R. F. Heran, assignor to The Pioneer Mfg. Co.*

A mildew resistant, drying oil base, paint composition consisting essentially of a pigment including ferri-ferrocyanide, copper naphthenate and a vehicle suitable for use with copper naphthenate, the ferri-ferrocyanide and the naphthenate being present in amounts between about 0.36% and about 3.62% by volume of the paint composition and between about 1.0% and about 3.0% by volume of the paint composition, respectively.

Gas Plating

U. S. Patent 2,837,442. *June* 3, 1958. *R. P. Seelig and R. L. Wachtell, assignors to Chromalloy Corp. of New York.*

The method of applying a shiny glossy chromium rich layer on an underbase metal selected from the class consisting of molybdenum, a molybdenum alloy, tungsten, and a tungsten alloy which comprises maintaining said underbase metal at an elevated temperature of about 1900°F. for a period of several hours in a substantially oxygen-free atmosphere while the underbase metal is in the presence of a powdered chromizing pack comprised of ferro-chrome, an inert filler, a volatile halide and a minor quantity of free iron, the amount of said free iron being at least 3% of said pack.

Conversion Coating

U. S. Patent 2,837,449. *June* 3, 1958. *B. Blaser, assignor to Henkel & Cie. G. m. b. H.*

In a process of producing phosphate layers on iron surfaces, the step comprising immersing iron articles in an aqueous phosphatizing solution consisting essentially of the addition product of phosphoric acid and an amide of a low molecular carboxylic acid containing from 1 to 3 carbon atoms to cause formation of a phosphate layer on the surface of said iron article.

Latex Paint

U. S. Patent 2,837,444. *June* 3, 1958. *F. J. Hahn, assignor to Monsanto Chemical Co.*

A porous surface carrying an undercoat of a quadricomponent interpolymer admixed with an oil modified alkyd resin and a top coat of a quadricomponent interpolymer, said quadricomponent interpolymer containing about (1) 35-60 parts of an unsaturated ester of the group consisting of straight-chain and branched-chain saturated aliphatic alcohol esters of acrylic and methacrylic acid containing a total of about 5-20 carbons in the alcohol radical of which about 5-14 car-

bon atoms comprise the longest continuous chain thereof, (2) 3-10 parts of an unsaturated nitrile of the group consisting of acrylonitrile and methacrylonitrile, (3) 2-5 parts of an unsaturated monocarboxylic acid of the group consisting of acrylic acid, methacrylic acid, cinnamic acid, atropic acid and crotonic acid, and (4) correspondingly, 60-25 parts by weight of a monovinylidene aromatic hydrocarbon.

Brighteners

U. S. Patent 2,837,472. *June* 3, 1958. *W. Gundel, H. Haas and W. Strauss, assignors to Dehydag, Deutsche Hydrierwerks G. m. b. H.*

An electroplating bath for producing electrodeposits of metals selected from the group consisting of copper, nickel and zinc, comprising an acid aqueous solution of an inorganic salt of the metal to be deposited and a compound selected from the group consisting of organic sulfonic acids having the structural formulas

$$Z{-}N(R_1){-}R{-}SO_3H$$

and

$$Z{=}N{-}R{-}SO_3H$$

and their salts wherein Z is a radical comprising a carbon atom directly attached to a sulfur atom, to an atom selected from the group consisting of sulfur, oxygen and nitrogen atoms and to the nitrogen atom of the

$$-N{-}R{-}SO_3H$$

group, R is a bivalent organic radical selected from the group consisting of aliphatic and aromatic radicals, and R′ is selected from the group consisting of hydrogen and aliphatic radicals, said organic compound being dissolved in said bath in sufficient quantity to produce bright metal-plating deposits therefrom.

Copper and Brass Brightener

U. S. Patent 2,838,448. *June* 10, 1958. *D. R. France*

A plating solution brightener for producing bright ductile deposits of a metal selected from the group consisting of copper and brass from alkaline-cyanide electroplating solutions comprising the following in substantially the following proportions, two ounces of sodium arsenite, ten to twenty ounces sodium nitrate, ten ounces sodium zincate, twenty ounces sodium hydroxide, sixteen ounces methyl alcohol, sixteen ounces formaldehyde, thirty-two ounces wetting agent, one to five grams tetraethylrhodamine and water sufficient to make one gallon of brightener.

Regeneration of Spent Pickle Liquors

U. S. Patent 2,838,376. *June* 10, 1958. *L. N. Allen, Jr., assignor to Chemical Construction Corp.*

A method of treating aqueous ferrous sulfate solutions which comprises admixing copper therewith in a quantity at least equivalent to the amount of iron to be recovered and heating the mixture in the presence of oxygen at temperatures above 400°F. and thereby forming a dense precipitate of easily filterable, black, crystalline iron oxide and a copper sulfate solution.

ABSTRACTS

Passivation of Metals as Corrosion Protection

By Prof. E. Raub: (Paper read at the Swiss Technical Plating Society Congress).

This paper was concerned with a survey of the present position of artificial passivation as a corrosion protection process for metals. The author discussed the characteristics of the oxide coatings which form on individual metals and then considered the production of passivating cover coatings on these metals. The alloying of chromium with iron was discussed as an outstanding example by which an exemplary rust resistance is obtained. Chromium also covers itself in air with an oxide coating which is practically invisible. By alloying chromium and the iron, this passivating cover coating of the chromium is formed on the surface.

This certain and permanent process of an oxidic cover coating which always renews itself, unfortunately for corrosion protection, is only applicable to a limited extent. For the production of suitable alloying composition a large alloying addition is necessary, or else the passivating addition metal which produces the protecting oxide coating loses this characteristic.

Mention was then made of the plating of metals which form passivating cover coatings. Thus, for example, chromium plating can be mentioned, whose function is not to take over the actual rust protection process, but to protect the underlying metals such as nickel, from discoloration. Rhodium plating also follows the same objective, but limits are set to this process on account of the high price.

Pores and Blistering of Plated Zinc Die Castings

By K. Ruttewit: *Metall* (German), **12**, No. 8, 713.

As die castings come off the machine, many will be found to have slight defects such as cold-weld areas, lap-overs, pimples, and small pores or hard inclusions. The usual procedure is to remove these by intensive polishing, followed by buffing. Apart from the appreciable effort involved to do this, excessive grinding and polishing can remove completely the casting skin and can open up pores which are located under this skin. These pores will become fouled and filled with the polishing compound and metal dust and, if they are quite small, are not easily seen with the naked eye. The trapped polishing compound is often removed only partly during the subsequent degreasing. In the plating bath, there will be parts which have pores, some of which are filled with polishing compound, while other pores, which have been emptied, become filled with electrolyte which is plated over and trapped. Parts of this nature are not suitable for plating, if serious trouble is to be avoided. As a result of this condition, blistered coatings will be obtained which, under some conditions, will lift completely away from the subsurface.

Excessive polishing accordingly should be avoided for all die cast parts, which are subsequently to be plated. Moderate surface defects on the castings, however, can be dealt with by careful and cautious polishing, taking care not to remove completely the relatively thick casting skin.

To obtain thorough degreasing prior to plating, Swiss practice has turned to ultrasonics. This combination of chemical and mechanical degreasing has been found satisfactory; any depressions in the surface of the casting can be cleaned out in a perfect manner.

Apart from the trouble caused by excessive polishing and buffing, investigation has shown that a fundamental relationship exists between the prepolishing and the subsequent copper plating. It has been established that, in many cases, a diffusion coating is formed between the zinc alloy and the deposited copper. X-ray structural examinations on such a diffusion coating

have shown that all the stable phases of the zinc-copper system are present in it. Below are the particularly brittle gamma and E phases. The brittleness of the diffusion coating is determined by these two phases. Although views on the connection between this diffussion layer and blistering deviate, further investigations have shown that a heavily polished surface also gives a thicker diffusion layer than a lightly polished surface. This agrees with practical experience, that die cast surfaces which have been overpolished tend much more to give blistering troubles on plating, than surfaces which have been carefully polished. It is a fact also, that such troubles can appear during plating and then vanish again, without any change being made in the plating procedure or the baths. The cause, obviously, is to be sought with the condition of the die casting, as passed into the plating bath.

The duration of the alkaline cleaning also has the same influence on the formation of the diffusion layer as overpolishing. The longer the treatment lasts, the thicker is the diffusion coating formed. It has been found in practice, that a precise maintenance of the cleaning time and the use of milder degreasing media considerably reduced blistering. A time of 30 seconds is recommended as the maximum for cathodic cleaning. A change from cathodic to anodic cleaning is recommended in many cases. It is assumed that undesired activation of the zinc surface by hydrogen occurs with too long a cleaning treatment. In order to prevent diffusion of the copper plate into the basis metal, a copper coating of at least 5 microns and, preferably of 7.5 microns should be applied. Too thin nickel coatings are also useless.

Methods for Evaluating the Quality of Tinplate

By W. E. Hoare. (Paper read at the International Tin Research Congress, Hannover, Germany.)

The single physical test process for tin coating thickness determination, which has been developed so far that it can be adopted as a routine test process, is the fluorescence process with X-rays. The various magnetic and electromagnetic test processes are quite definitely useful for certain purposes. The thickness of the tin coating on tinplate produced for can pack manufacture is so small, however, that these test processes are not sufficiently accurate.

A test apparatus has been developed by the British Iron and Steel Association which is based on a somewhat different principle, the application and measurement of high-frequency eddy currents. With this apparatus, coating thicknesses within a range of 0.75 to 10 microns are measured with accuracies of $\pm 15\%$.

In the application of X-rays for testing, the rays penetrate the tin coating and fluoresence at the iron-tin interface but not at the tin surface. The secondary radiation passes back through the tin coating and the intensity is measured on its return. It is clear that, with an impinging radiation of known impingement angle, the intensity of the returning radiation is dependent on the thickness of the coating. The sensitivity of the process is sufficient for tinplate testing and is adapted for routine testing on hot dip tinplate. The apparatus used, however, is fairly expensive so that a high production or a large consumption of tinplate is necessary. However, attempts are being made to simplify the apparatus and it would appear that this method will become more widely used in the future. With tin coatings of the normal thickness, the accuracy of this test method lies in the region of $\pm 5\%$.

In a comparison of the various test procedures it can be stated that selective solution and weighing usually provides a figure for the coating thickness or the weight of the complete coating, tin plus tin-iron alloy. The iodine titration method gives a value covering the total tin, i.e. free tin plus alloyed tin. The X-ray fluorescence test gives a result which is associated with the total coating thickness. Actually, however, it is dependent on standardization by one of the other processes.

Metal Plating in Sheet Processing

By E. Roub. (Address at the Congress of German Sheet Producers Research Association, Duesseldorf.)

Throwing power is dependent on the primary current distribution, which can be obtained only with very simple shaped parts, and also on the polarization and the current efficiency. In respect to these factors, a direct determination of the throwing power is not practically possible. Accordingly, it is ascertained indirectly by measurement of the coating thickness of the deposit at various points. For the determination of average metal distribution, small cups with a diameter of 3-24 mm. and varying depths were used as test parts. The baths used for the investigation were Watts nickel and bright nickel as well as cyanide and acid copper baths.

The throwing power is dependent on the shape of the work part being processed. With test cups with a diameter of 3 mm. and 3 mm. depth, greater deposits occur in agitated copper baths than in still baths. This is a phenomenon which corresponds to practice. The shape of the parts acts very strongly in this connection.

Further, the leveling action of the baths was investigated. For this purpose, cuts about $\frac{1}{10}$ mm. in depth were made in the basis metal with varying opening angles. The leveling action obtained depends on the type of bath, the operating conditions and the shape of the surface irregularities. With the same bath, a positive and a negative leveling can be obtained. The actual effect depends on the crystallization of the deposits and, accordingly, on the working conditions during electrolysis.

In general, it can be said that, with a good macro-distribution, the leveling effect is worse and the reverse holds good. The effect became clearly apparent involving the growing-over of narrow openings and the closing-up of these. Such narrow openings can correspond to grinding fissures and marks in practice.

This closing-up of depressions in the surface starts from the upper edges and sometimes proceeds so rapidly that the depth of the depression often ceases to receive any deposit, as the channel of the fissure has already been bridged over. In this way, hollow spaces can be built up which are filled with residual solution and which accelerate corrosion from the interior of the deposit.

Several further points were raised in the discussion, regarding to what extent there are relations present between the pH value of the bath and the throwing power. It was also recommended that the test cups used to determine the throwing power of the plating bath should be included in a new standard on the subject. It was also suggested that masked pores could arise from previous cleaning and polishing treatment of sheet prior to plating, the pore and scratch crevices and pits being filled with the compound used. These pits and crevices were then bridged over by the plating, and this could be responsible for poor corrosion values subsequently obtained, particularly with bright nickel coatings.

Anodic Processes at Metal Electrodes with Electropolishing

By Prof. Lange. (Paper read at the 54th Congress of the German Bunsen Society for Electrochemistry.)

The author discussed some special characteristics of dual electrodes. Apparent deviations from the Faraday law of electrolysis have been found in electropolishing. According to Lange, these deviations can be explained as follows: The anodes represent what are termed mixed electrodes. This implied that, with these electrodes, two reactions take place, side by side, a cathodic and an anodic.

Chemical and electrochemical polishing of metals were then discussed. The smoothing may be defined as a process by which surface roughnesses with a depth of about 1/100 cm. and just as great a width, are smoothed down. One then speaks of the surface as brightened if the surface roughness depths are of the order of 10^{-4} cm.

Diffusion coatings are important both with electrolytic and chemical polishing. With anodic electropolishing, the stationary diffusion coating over the prominences is of smaller thickness than over the depressions. A difference in the electrochemical potential is formed, which leads to an increase of the local current density at the peaks, thus to a leveling. The diffusion coating in chemical polishing possesses a particularly high viscosity.

It is often found that, with anodic electopolishing, high voltages and resistances occur at the metal surface. Such metal surfaces can no longer be wetted by mercury, as has been shown by Hoar. Even luminescence phenomena are often found. These are always strong indications of the presence of a practically pore-free oxide coating. It was mentioned that, with true classical polishing processes, oxide coatings can quite well occur; these however play a subordinate role in the mechanism of the polishing process. It is false to speak of passivity in electropolishing. As is known, the metal dissolves, even after exceeding the limiting current range, with an appreciable current efficiency.

Formation and Growth of Plated Metal Coatings

By H. Fischer. (Paper read at the 54th Congress of the German Bunsen Society for Electrochemistry.)

Film formation can be divided into two stages. The first stage consists of a vertical film growth. The growth coating thickness is determined by this. The growth parallel to the surface of the basis metal follows in the second stage. In the first stage, the upper surface of a nucleus is assumed as active. A very high current density rules here. The supply of metal ions is thus rapidly exhausted, so that a further growth in the vertical direction is no longer possible. It is assumed that the first, vertical growth stage only lasts for about one-millionth of a second.

The sideways growth lasts considerably longer. It proceeds parallel with the vertical growth. When, precisely as with the vertical growth, the supply of metal ions is used up, then the deposition at the side surfaces ceases. Through this, the growth nucleus has become inactive. A new coating nucleus then forms again on the upper surface and so the process proceeds further.

A part of the surface of the deposited metal is always inactive, so that the active portion of the surface, at which thus the integration of metal atoms can take place is only a small fraction of the total surface. From this it follows that the actual current density at these active centers is very much greater than the average.

Regarding the relationships ruling with the film nucleus formation, the duration of this stage amounts to, as can be ascertained from the thickness of the growth coating determinable by the electron microscope, to about 10^{-5} to 10^{-7} seconds. At the individual growth coating nucleus there rules an enormously high, actual current density so that the solution in its neighborhood is rapidly impoverished in metal ions. The growth in the vertical direction is then interrupted. The side surface now becomes active. During the sideways growth, by concentration balance, the original relationships at the upper surface have again formed, i.e. this part again becomes active. It will easily be seen that the duration of the coating growth in the vertical direction depends on the metal ion concentration in such a manner that, with increasing concentration, the duration and, accordingly, the thickness of the vertical growth coating increases.

It was shown that with increasing inhibition, the duration of the parallel coating growth decreases. While, with the field-oriented isolation type of plated metal, the time of the parallel coating growth can be 10,000 times longer than with the vertical growth, with the non-oriented dispersion type of plated metal, which is of special significance to metal plating practice, both phases are of approximately the same duration. Corresponding to this, the individual crystallites are almost as high as they are broad.

DIPPING AND FLOW COATING METHODS

(*Continued from page* 61)

A safety purge system should be used that is in accordance with fire insurance companies' requirements. This is usually incorporated with the automatic viscosity control equipment, and several commercial types are available.

After the product has been conveyed through the flow coat unit and drain tunnel, it is then carried through a vapor tunnel. It should remain in this ventilated tunnel until such time as the paint has thoroughly flowed out. In most cases the air in this vapor tunnel is recirculated in order to hold the solvent concentration at a desired level. The ratio of this recirculated air to the amount exhausted is determined by the paint used and the nature of the work that is being painted. Usually it is about 3 to 1, or 75% recirculation, 25% exhaust. This may vary in some cases, but can be applied to most installations. Adequate ventilation is a must, and provision so that vapors and fumes cannot escape should be made at both the entering and leaving ends of the machine.

A reliable paint filter of the automatic type should be used to prevent the possibility of contamination of the materials. It is also wise to use a recording controller to keep a constant check on the viscosity, temperature, and other pertinent factors. It is also necessary that all motors, controls, and other electrical equipment be of the explosion proof type when they are located adjacent to the machine. Fans should be spark proof as recommended for hazardous locations.

Fire protection, which in many cases should be automatic, must also be provided, and this should be of a type that is approved by the fire insurance company.

The cost conscious executive will be in constant search for a process which will eliminate or minimize all associated costs to produce and sell his product. Making his organic finishing line more automatic should be high up on his list of changes and modifications.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Anodizing Rack

Anodizing Rack Div., Service Screw Products Co., Dept. MF, 133 No. Green St., Chicago 7, Ill.

Anodizers no longer need to junk or rebuild expensive anodizing racks due to style or design changes in the parts being processed. A new titanium adjustable racking system can be revised instantly to accommodate wide variations in sizes or shapes of parts. The degree of adjustment is continuous from as little as one one-thousandth of an inch to as much as 32 inches.

The rapid changeovers are accomplished by means of a newly perfected rigid titanium spline and disc-type titanium workholders fitted with integral clamps. The discs can be positioned quickly and positively at any desired location on the spline. A virtually unlimited variety of parts can be racked on the available disc types.

Complete titanium construction assures maximum corrosion resistance, longest possible rack life and eliminates the requirement for stripping. Constant contact and tension are maintained throughout each parts run, assuring uniform anodic film thicknesses and excellent color match. Rejects and reruns are reduced to the absolute minimum. Rack maintenance and repairs are practically eliminated.

Job shops can revise the racks so quickly that they can be switched from job to job on a continuous schedule. In-plant anodizers can economize on the costly design and replacement of large quantities of racks often required by even minor "face-lifting" changes.

Grease Stick

Schaffner Mfg. Co., Inc., Dept. MF, Schaffner Center, Pittsburgh 2, Pa.

A new grease stick to be used in the metal finishing industry, G.S.-7205, is a combination of light-bodied greases that will spread easily on the abrasive belt or wheel, prevent logging or clogging, and prolong the time efficiency of each.

It is particularly recommended for slow moving belts or wheels, where there is not enough surface feet per minute to melt conventional type greases.

Printed Circuit Photo Resist Stripper

Sel-Rex Corp., Dept. MF, Nutley, N. J.

Most photo resist materials used in printed circuit manufacturing may be removed by a 30-second dip in new Resistrip, according to an announcement. The new cold stripping solution is said to provide two important advantages which can result in substantial increases in production. (1) Stripping time is reduced to a fraction of the time required through conventional means. (2) Its use results in chemically cleaner surfaces ready for subsequent plating or dip soldering operations.

The formulation, for which a patent is pending, contains a special ingredient designed to minimize rejects of costly completed circuit boards. Any traces of photo resist not removed by the initial 30 second dip are said to show up clearly as brownish film. It is claimed this feature will eliminate rejects due to faulty plating and short circuiting often traceable to incomplete removal of photo resist. This "self-indicating" feature is also said to facilitate gauging of immersion-time required to remove photo resist of different types and varying thicknesses.

According to the manufacturer, the material is non-combustible and extremely long-lived. An "emulsifying blanket" which retards evaporation reportedly makes the material very economical to use.

Chromate Coating for Zinc

Heatbath Corp., Dept. MF, Springfield 1, Mass.

Duracoat D-Y, for producing a wide variety of brilliant metallic colors on zinc plate at low cost, is a powdered chromate material and solutions are made up using only 1⅓ ounces per gallon of water plus a small amount of nitric acid. This produces the clear blue bright chromate film that can be dyed various colors.

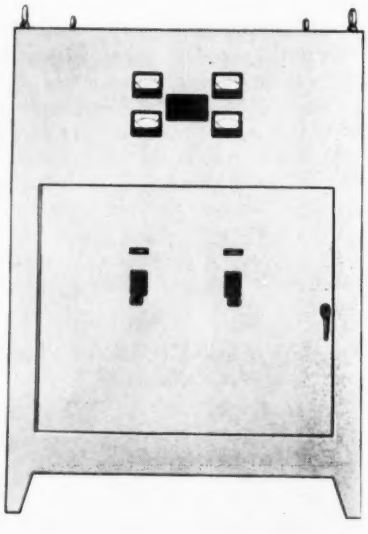
An excellent assortment of dyes is available for dyeing the chromate films produced. The dye solutions are made up using ⅓-⅛ ounce of dye powder per gallon of water.

Extremely low cost for the materials required, long life, and simple control are the outstanding features of the process, it is claimed.

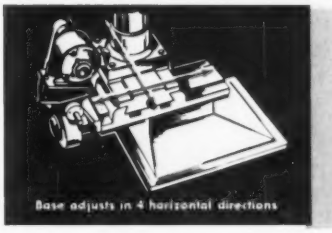
Silicon Rectifier Units

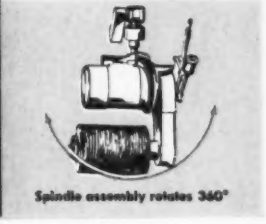
Syntron Co., Dept. MF, Homer City, Penna.

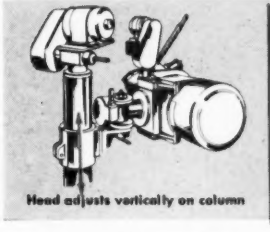
The above manufacturer's rectifier power units, regularly available with selenium rectifiers only, have been improved to include the choice of silicon rectifiers as well. This improved line offers the same dependable features as previous units, high efficiency (92 to 97.5% power factor, 10% voltage regulation from no load to full load, 4% ripple, very low no-load losses, and high overload capacity), simple installation, low maintenance requirements,



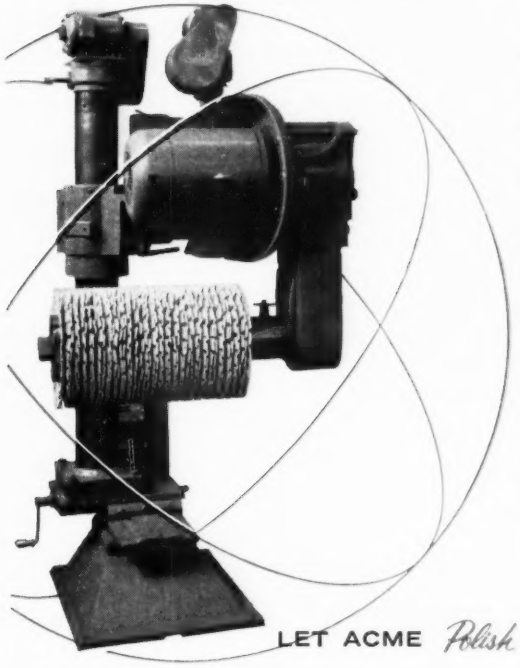
ACME G-4 KEEPS CONVERSION COSTS DOWN!


Base adjusts in 4 horizontal directions


Spindle assembly rotates 360°


Head adjusts vertically on column


Head feed is motorized



If you want machines that will set up for a fast, efficient finishing job on today's work—yet will quickly and easily adapt to next year's designs—ask an Acme engineer to show you the versatile G-4 lathe.

What does the G-4 do? Just about everything! Only four of its many adjustments are illustrated. Without the need for superstructure support, the buffing or polishing head may be faced in four directions horizontally and two vertically. It may be angled to any degree from horizontal to vertical. It may be stationary when it operates, or set for a stroking or oscillating movement. It finishes the most common or the most unusual shapes . . . reduces belt, buffing wheel and compound costs . . . and is ready for adaptation to new designs any time!

An Acme engineering specialist can help you combine these flexible basic units with automatic work-holders or fixtures to give you a set-up for low-cost, high-production finishing. Contact him to discuss your current or anticipated demands. No obligation, naturally.

LET ACME *Polish Off* YOUR FINISHING PROBLEMS

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN JORDAN 6-1550

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

and indefinitely long, continuous operation, plus the wider application possibilities and greater user selection made possible by the availability of selenium and silicon rectifiers.

Standard three-phase units are available in KW capacities ranging from ¾ to 500 for single units. Larger capacities are easily possible with combinations of units. Single-phase unit watt outputs range from 250 to 3000. Special low voltage power units offer capacities of from 1000 to 10,000 amperes in standard 6, 9, 12, 18, 24 and 48 volts d-c.

Paint Mixing Machine

Beck Equipment Co., Dept. MF, 3350 *W. 137th St., Cleveland* 11, *Ohio.*

A new line of low-cost Thor-O-Mix paint mixers in two sizes, Model A for gallons and smaller, Model B for quarts and smaller, are of entirely new design and construction, and employ a unique "pitch-tilt" throwing action that assures fast, thorough mixing of all kinds of paints or liquids. Even tightly caked pigments, metal pigmented paints, transparent color paints, house paints, etc., are quickly broken up and mixed in minimum time.

The machine consists of a frame which houses the 60 cycle 110 volt electric motor, as well as the gearing and eccentric which drives a rubber connecting rod to vibrate the cradle as it rocks on its two rubber bearing blocks. The oil bronze bearings require no oiling. Rubber gripping pads, tightened by a hand-knob, hold either round or square cans in the cradle. Containers cannot fly loose or shake out.

Four rubber suction feet cushion the vibration and prevent creeping. A convenient on-off switch is provided. Machine is light weight for portability and compact for space saving on floor or counter.

Expanded Titanium Sheet for Use in Plating

Mallory-Sharon Metals Corp., Dept. MF, Niles, Ohio.

Expanded titanium sheet for use in the plating and chemical industries will be available in gauges from 0.050 to 0.125″ into ½″ to 1½″ diamonds, in standard 48″ by 96″ sheets. Tests show the material can be bent over a radius four times the metal thickness in either the longitudinal or transverse direction after sandblasting and pickling. Annealing does not improve the bend factor.

Expanded sheet will be available in unflattened or flattened mesh, with the flattened mesh being primarily for decorative purposes. Prices on the new material, which is now available in production quantities, will vary with gauge and strand widths.

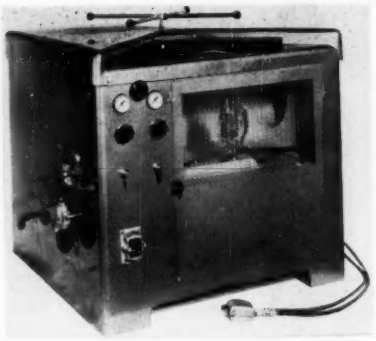
Company technicians believe the new material will have wide applications in acid plating, in protection shields for immersion heating electrodes and in acid dipping baskets. Chief advantages of the material are its extreme resistance to corrosion, and the fact that in plating operations, the titanium itself does not draw any current.

Spray Decorating-Mask Washing Machine

Conforming Matrix Corp., Dept. MF, 349 *Toledo Factories Bldg., Toledo* 2, *Ohio.*

The first machine which successfully combines the functions of automatic spray decorating equipment with automatic, efficient mask washing is expected to have quick acceptance by those who do spray finishing which employs masks with fine detail, or where a heavy material is used for decorating and only a few shots can be obtained on a mask before washing becomes necessary. Continuous production is now possible, with clean masks being immediately supplied as frequently as required.

When the mask being used needs washing, the operator simply indexes a rotary plate to which four masks are attached. The soiled mask is automatically cammed into the washer, a second mask moves from the first to a second washing station, from where a third mask passes to a blowoff which removes pockets of solvents and then moving into a drying station, from



which emerges the fourth mask which goes into position for continued spraying. A clean, dry mask is made available in less than a second, and the operator at no time need handle the masks.

Any of the three basic gun movements, straight line (reciprocator), spinning (whirling guns for circular work), and oscillating (multiple-pass), can be installed in from four to five minutes.

Solvent consumption is very low. By baffling and controlling air currents within the machine and washer, fumes are prevented from escaping.

The machine will paint areas up to 6″ x 6″ square or diameter. Simplicity of design is evident throughout. Only 56″ x 50″ floor space is required. The hood and top can be removed to expose the entire plenum chamber and washer.

Porcelain Enamel Stripper

Kolene Corp., Dept. MF, 12890 *Westwood Ave., Detroit* 23, *Mich.*

Porcelain enameled production rejects are now being reclaimed quickly and economically through the use of a chemical process known as Kolene deNAMEL. Single or multiple coats of porcelain enamel are completely removed in 5 to 15 minutes immersion, it is claimed, and no trace of porcelain remains, not even in corners, crevices, or paints of heavy build-up. There is no attack on the basis metal.

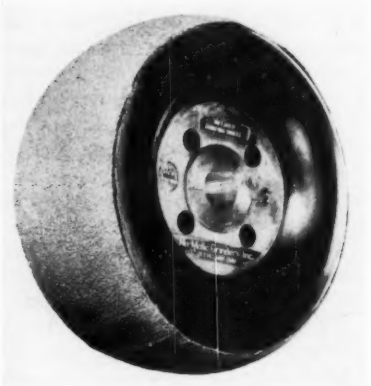
After brief immersion in the stripper, the parts are water rinsed, and are then ready for production enameling.

A typical installation is comprised of a chemical bath, control-panel operated to maintain the necessary 900° to 950° temperature of the bath, plus a water rinse tank. Mechanical agitation of the bath insures excellent heat transfer, circulates sludge and controls sludge settling in the sludge zone.

Crowned Finishing Wheel

Nu-Matic Grinders, Dept. MF, 8224 *Carnegie Ave., Cleveland* 3, *Ohio.*

Now a concave surface with radius as small as 2 inches can be polished with a standard 5 inch diameter Valcore inflated finishing wheel, using a new coated abrasive band that is crowned in the center. The new band is designed for use with a Model 525 which is 2½ inches wide. When inflated, the wheel has a major diameter of 6 inches at the crown. Crowned bands are carried in stock in both medium and fine grits. Bands for other models are made to order.



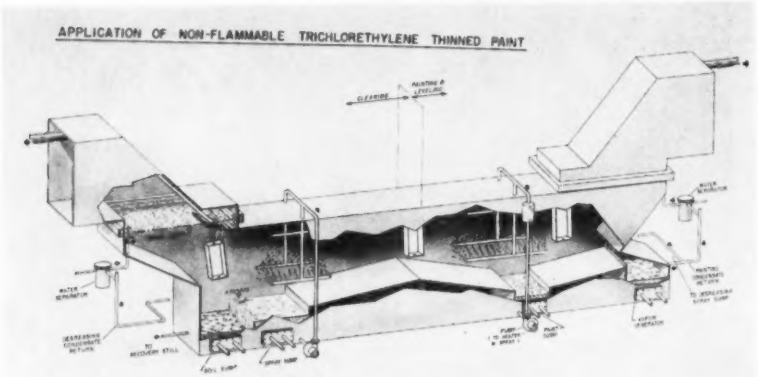
Having a compound curvature, the new wheels will handle many finishing jobs that ordinarily would require the use of two wheels and two portable tools, it is claimed. Also, sidewall wear that results when working on areas that are difficult to reach is said to be eliminated. This wheel is particularly suited for spotting work.

Cleaning and Painting

Du Pont Electrochemicals Dept., Dept. MF, Wilmington 98, *Del.*

By integrating vapor degreasing with application of paint by flow coating, a new process sharply reduces initial investment, operating costs, and floor space requirements compared to present methods of operation. By using the same solvent, nonflammable trichlorethylene, for vapor degreasing and paint thinner, savings inherent in flow coating methods are realized, and flammability hazards eliminated.

Savings of as much as 50 per cent in initial investment and operating cost are possible by use of the trichlorethylene-based system, it is claimed. Principal savings result from the recovery of oversprayed paint and volatile thin-



MONORAIL EQUIPMENT FOR INTEGRATION OF VAPOR DEGREASING WITH FLOWCOATING

ner. Important economies in labor and utilities costs also are affected by combining cleaning, painting, and drying steps in a single machine. All operations are carried out beneath a protective blanket of trichlorethylene vapor. Work enters at one end, is cleaned, painted, and removed from the machine free of trichlorethylene thinner.

When an air drying paint is used, the parts are dry and ready for shipment when removed, since evaporation of the thinner occurs instantly as the part leaves the machine throat. When a baking paint is used, the parts proceed immediately to the baking operation. Where a second coat of paint is desired, in some instances it can be applied prior to baking the primer, and the two coats baked together.

Tests show that trichlorethylene-thinned paints with properties similar to those of most conventional paints can be formulated. In general, any paint ingredient which is soluble in trichlorethylene, such as certain alkyd resins, epoxy esters, acrylic resins, asphaltic materials, chlorinated rubbers, etc., can be used in compounding trichlorethylene-thinned paints. Paint can be pigmented, and may be decorative as well as protective in nature.

Present machinery was designed for automated production line use, but can be adapted easily for other types of operations, including dip painting instead of flow coating.

Phosphate Coating

Klem Chemicals, Inc., Dept. MF, 14101 Lanson Ave., Dearborn, Mich.

A new idea and process in iron phosphates is used at temperatures as low as 70°F. to a maximum of 120°F. Coating weights up to 150 mg./sq. ft. are attained, depending on type of metal and concentration.

The savings in heat are obvious and chemical costs are lower due to the absence of evaporation. Maintenance costs are also lower, due to easier cleanout and less breakdown.

Remote Controlled Ultrasonic Generator

Branson Ultrasonic Corp., Dept. MF, 40 Brown House Road, Stamford, Conn.

The Model APT-500 Sonogen generator, having a 3-kw average power output, is designed for high-volume, all day production cleaning, and will activate up to 6 sq. ft. of transducer area, or 300 gallons of cleaning solution. The unit features motor tuning, twin oscillator construction and, for the first time, remote control.

The remote control panel connects to the generator through a multi-conductor cable. It is ideal for many production cleaning set-ups, because the panel can be incorporated with other instruments located at a central control area. The operator can thus adjust the entire cleaning procedure without leaving his post.

Weighing 350 lb., the unit measures 30 x 24 x 72 in. high, and is constructed of $\frac{1}{8}$-in. aluminum to reduce eddy current losses. Removable panels, with safety interlocks, allow easy access for servicing.

Phenolic/Vinyl Coating Process

Union Carbide Plastics Co., Dept. MF, 30 E. 42nd St., New York 17, N.Y.

A new phenolic/vinyl system of maintenance coatings for metals, a system that eliminates costly sandblasting surface preparation, calls for use of a phenolic resin-based primer and vinyl top coat to provide protective advantages of vinyl coatings without costly surface preparation.

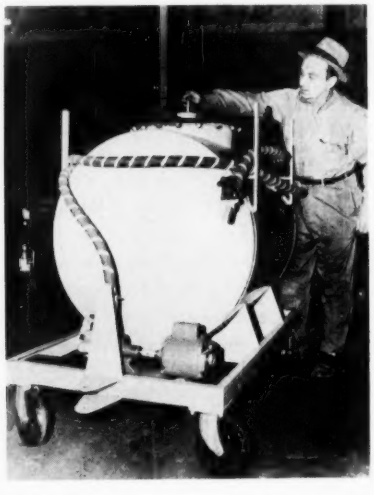
Formerly, when all-vinyl systems were used, it was necessary to sandblast the rusty metal surface before applying primer. Surface preparation was minimized when an oleoresinous primer was used, but the solvents in vinyl solution top coatings tended to lift the undercoat.

Now, with the new phenolic/vinyl system, surfaces need only wire brushing before primer and top coat are applied and, since this eliminates sandblasting, a process as costly as all other steps combined, the economies of the new system are considerable.

Portable Acid Handling Unit

Perma-Line Rubber Prod. Corp., Dept. MF, 1755 No. Winnebago Ave., Chicago 47, Ill.

This new acid transportation buggy complete with acid proof accessories consists of a steel tank lined with rubber $\frac{3}{16}$" thick. A 35 g.p.m. all rubber



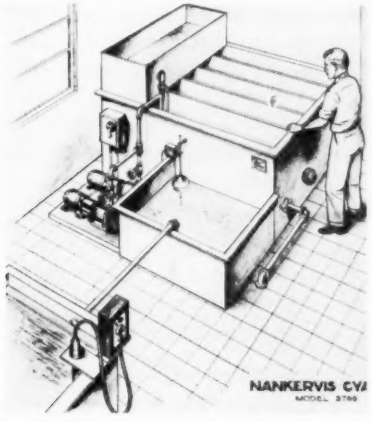
centrifugal pump with carbon seal is provided, as well as an acid proof rubber hose. The pump is powered by a ⅓ hp motor @ 3450 r.p.m.

Cyanide Waste Disposal Unit

George L. Nankervis Co., Dept. MF, 15300 *Fullerton Ave., Detroit* 27, *Mich.*

This new unit is designed for treatment of cyanide wastes and has been designated as the Model 5769 Cyanizer. It is built as a package unit and includes tanks, pumps and controls.

The unit consists of a sump tank, baffle tank, pumps and controls. In operation, the cyanide wastes are collected in the sump and then pumped into a uniquely designed baffle tank where they are neutralized by a concentrated sodium hypochlorite solution. The baffle tank retains the wastes



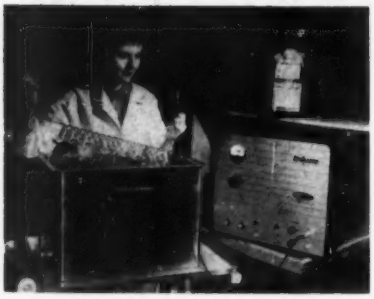
for treatment for a period of one hour while the sodium hypochlorite is automatically metered into the solution in proportionate amounts to obtain complete neutralization. The entire process is automatic and continuous in operation. Discharge from the unit is completely neutralized and can be dumped safely into municipal sewer systems.

The equipment is easily installed, requires no operator, is easy to clean and is available in various sizes to accommodate larger or smaller flow rates. It has been approved by many municipal sewer commissions.

High Power Ultrasonic Cleaner

Narda Ultrasonics Corp., Dept. MF, 625 *Main St., Westbury, New York.*

The Series 5000 SonBlaster consists of a 40-kc, 500-watt output Model G-5001 generator and a 10-gallon capacity transducerized cleaning tank Model NT-5001. The stainless steel cleaning tank measures 20″ x 12″ x 11″ deep,



and is deep drawn to eliminate cracks and crevices which might entrap soils.

The generator may be used to energize as many as ten submersible transducers (Model NT-605) adapted to existing solvent, vapor or alkaline soak tanks of any shape or size up to 30 gallons capacity. Also, this generator will drive various combinations of smaller tanks. The tanks may be furnished with recirculating systems for filtration and temperature control of cleaning solutions.

The new generator operates on 110/220V-50/60 cps supply and consumes only 8 amp. It contains a separately fused, high voltage supply with full wave rectification and filtering to provide continuous high level power input to the drive circuits. The power drive circuitry provides more than 500 watts average power input to the transducer. Special stability circuits are provided to prevent radio frequency radiation and a line interference elimination circuit is used to prevent interference in electrical equipment operated from the same power source. The unit is wired with a safety interlock switch to remove shock hazard if the cabinet is opened. The new generator is air cooled for continuous operation and may be controlled locally or from a remote point.

Chromate Coating for Cadmium and Zinc

Heatbath Corp., Dept. MF, Springfield 1, Mass.

A new versatile and inexpensive chromate powder called Duracoat H-6-2, for producing iridescent golden chromate finishes on zinc and cadmium plate as well as on zinc die castings, is made up using only 2-4% per gallon of water and requires no separate additions of other liquid acids for make up or during use. The iridescent golden chromate films produced are extremely corrosion resistant and serve as excellent bases for painting. Low cost, long life and ease of control are outstanding features of this new product.

Portable Paint Heater

Spee-Flo Co., Dept. MF, 6614 Harrisburg Blvd., Houston, Tex.

A new and improved portable paint heater, called the 300 B2, is carried by the operator and is especially suitable for maintenance and construction painting and any work that requires compactness and portability. The unit gives all the advantages of hot spray such as elimination of runs and sags, reduction of overspray and the use of one coat in place of two.

This new, lighter weight model combines a higher wattage heating unit with a plastic-insulated portacase. It is comfortable for the painter because no external heat is felt. Electrically operated from a standard light circuit, the unit is complete with hose and electric

cable set. The explosion-proof heater contains no moving parts and is maintenance free. It can be installed in any conventional painting system in a few minutes. Cleanout or color change is accomplished with the usual solvent flush of the paint lines.

Rated at 10 gallons per hour, the unit is big enough for almost any job and lists for less than $150.00.

Graphite Pipe and Fittings

Falls Industries, Inc., Dept. MF, Aurora Road, Solon, Ohio.

A completely re-engineered corrosion proof piping system composed of standardized pipe lengths and fittings, can be fitted easily in the field with only a hacksaw and a wrench because it is made of impervious graphite. The Impervite piping system utilizes glass fiber armor to protect against physical abuse, standard ASA flange bolt circles to permit attachment to existing equipment or other pipe, and the I.D. dimension equals the listed pipe size dimension to simplify calculations. In addition, the wall thickness is approximately twice that formerly used.

The impervious graphite material, from which this pipe is extruded, is unaffected by practically all corrosives except a few highly oxidizing agents. It is non-contaminating, immune to effects of thermal shock, and is recommended for use at temperatures to 340°F at pressures to 75 psi hydrostatic. (50 psi steam.)

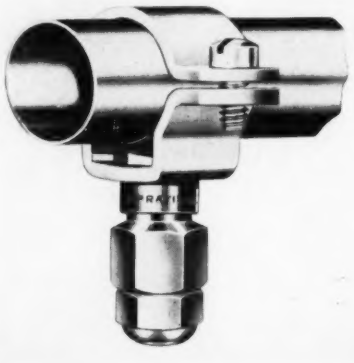
All armored pipe and fittings are furnished with flanges attached. Joining is accomplished by gasketing between flanges. Pipe is supplied in standard lengths of 72″. Shorter lengths can be made up easily in the field by cutting a standard length with a hacksaw, then attaching flange. Standard fittings include 90°ell, 45°ell, tee, cross, blind flange cap, reducer, flexible coupling and sight fitting. Special fittings are furnished to specifications.

Spray Nozzle Connector

Spraying Systems Co., Dept. MF, 3245 Randoph St., Bellwood, Ill.

Designed for liquid, gas and air lines and for pressures up to 250 psi, Split-Eyelet Connectors provide leak-proof connection and overall simplified mounting of $\frac{1}{8}$″ and $\frac{1}{4}$″ spray nozzles of all types. These connectors are supplied in clamp sizes to fit $\frac{1}{2}$″, $\frac{3}{4}$″ and 1″ pipe and $\frac{13}{16}$″, $\frac{7}{8}$″, 1″, $1\frac{1}{16}$″, $1\frac{1}{4}$″ and $1\frac{3}{8}$″ O. D. tubing. Equipment such as gauges or hose may also be easily mounted to lines with these new connectors.

Design features include twin-bolt clamp compression, heavy duty clamp in cadmium plated steel or stainless steel, Buna N gasket, choice of connector body materials in brass or stainless steel, and hexagon body shape to



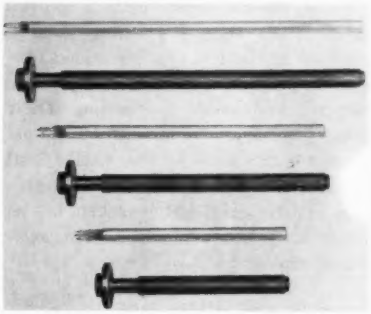
prevent turning of body when nozzles or fittings are tightened in place.

In this split-eyelet design, the body unit is separate from the clamp member and liquids or gases come in contact only with the body. As a result, the body can be offered in metals most compatibile with the liquid or gas handled, of particular importance where corrosive materials are involved. Further, the clamp member is made in heavy duty steel or stainless steel for maximum possible leverage and thread strength under compression. These quality built connectors provide a secure, leak-proof mounting that cannot loosen or break.

Immersion Electric Heater

Thermel, Inc., Dept. MF, 9400 Robinson Road, Franklin Park, Ill.

A new immersion electric heating unit, in which the cast insert may be



easily removed from the outer shell assembly, makes possible the changing of the insert without draining the tank.

These inserts are available for pipe and finned tube heaters, and are made in 7-10-14 kw, 220, 440 and 550 volts; single and 3 phase; for 3" pipe and up, Schedule 40, with lengths from 2 ft. to 6 ft.

Paint Spray Gun

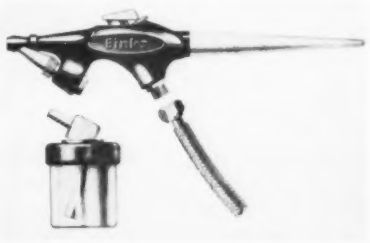
Binks Mfg. Co., Dept. MF, 3122 Carroll Ave., Chicago 12, Ill.

Capable of producing a pencil thin line, a broad shading or a stipple effect, a new, highly versatile air brush, the "Wren", is designed for small parts finishing and touch up.

The gun is available in two models. Model A sprays light to medium consistency materials such as dyes of all kinds and other light fluids and Model B for use with medium to light-heavy materials such as lacquers, enamels and other paints. Both models are siphon fed and capable of perfect atomization.

The air brush is specially designed to give a balanced feeling, providing the user every assistance possible in creating the desired effect. Simple air and color feed adjustments located at finger tips make it easy to adjust the spray pattern from pencil thin to broad shading with one hand and while moving the air brush only a few inches.

Color bottles ranging in size from



¼ ounce to 2½ ounces are available. The siphon type fittings and wide mouth bottles used on this air brush are easy to clean. Most standard ¾ ounce enamel bottles fit this air brush, enabling the user to spray directly from the material manufacturer's bottle. The closed bottle used on the gun eliminates the danger of spillage as might be encountered in using an open color cup, frequently seen with comparable equipment.

The unit uses only ¾ cfm of air at 25 to 30 pounds of pressure; this requires only an inexpensive compressor. The body is drop forged aluminum. The handle is made of Nylon. It weighs only 2 ounces and is approximately 6⅞ inches long.

Power Brushes

The Osborn Mfg. Co., Dept. MF, 5401 Hamilton Ave., Cleveland 14, Ohio.

The TY power brush performs deburring, finishing, and cleaning jobs beyond the reach of conventional wire brushes, it is claimed, and at the same time provides these additional advantages:

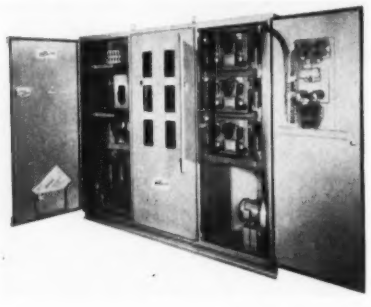
1. Significantly greater tool life.
2. Greater brushing action strength.
3. Minimum wire breakage.
4. Positive control over area of brush contact.

The brush is not a replacement, as such, for a standard wire brush. It is a new industrial tool, which opens up the door to more economical and extensive power brush application work. Manufacturing operations that utilize such tools as rotary files, abrasive stones or belts, tumbling and shot blast machines could now be economically and more efficiently replaced with this new power brush method, it is stated.

Oven Temperature Control

Weltronic Co., Dept. MF, 19500 W. Eight Mile Road, Detroit 41, Mich.

Truly variable, stepless control of power, and resulting heat, is claimed for a new line of electronic power controllers for electric infra-red ovens. Such control is achieved through the use of electronic thyratron and ignitron tubes, and a phase-shifting control device. Absence of magnetic contactors and all mechanically moving parts reduces maintenance problems (such as the dressing of contact surfaces).



Any percentage of the total power available may be delivered by setting a single dial. Automatic features include automatic switching between pre-set high-heat and low-heat levels when conveyors are not constantly loaded, and automatic shut-down if oven fans fail to operate or temperatures build too high. The largest standard model currently made is rated at 600 kw, and the smallest at 19 kw.

Plastic Gate Valves

Vanton Pump & Equip. Corp., Dept. MF, Hillside, N. J.

A complete line of socket-weld Flex-Plug plastic gate valves has been announced as immediately available in sizes from ½″-2″ in both PVC or styrene-copolymer.

The valve, first of its kind, offers the combined features of straight through no-pressure-drop flow with close throttling control. The combination of these two features of a gate and globe valve makes it one of the most versatile available.

Dry Chemical Portable Extinguishers

Walter Kidde & Co., Inc., Dept. MF, 675 Main St., Belleville 9, N. J.

Two new pressurized dry chemical portable fire extinguishers come in 2½ and 5 pound capacities and are claimed to put out as much fire as eight and sixteen carbon tetrachloride portables respectively.

Their designs stress simplified, self-evident operation for anyone picking up a unit in a fire emergency. Simply aim the discharge nozzle at the base of the fire and push the easily depressed actuating lever. Immediately a cloud of fire killing dry chemical envelops the blaze. There is no trigger locking pin

to remove, no valve to turn, no inverting, and no bumping.

Other features are cited by their manufacturer. Light-weight and functionally designed, they are easy to carry and handle, even with a gloved hand. Their rugged pressure gauges, recessed in the housing for added protection, tell at a glance if they are charged and ready for action. Their operating range of from 110 to 180 psi means that they can be easily and quickly recharged with air or nitrogen. Their special wall brackets act as the locking pin and discourage accidental discharge.

Air Blow Gun

Perfecting Service Co., Dept. MF, 332 Atando Ave., Charlotte, N. C.

An all new air blow gun is designed for easy handling and maintaining accurate control of the air stream. The contour styling of the gun fits the operator's hand and provides a natural and more comfortable grip. The trigger action eliminates any awkwardness in releasing or directing the air stream. This unique design and action does away with hand and finger fatigue. A slight natural finger pressure on the trigger releases any amount of flow required. The trigger uses a cam action to operate the balanced piston valve

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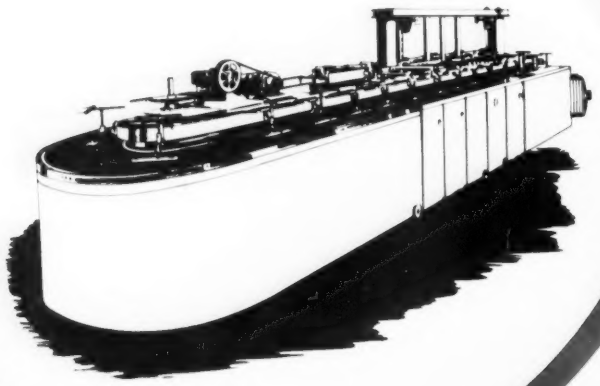

Because of its versatility, N222 can be used effectively with either mechanical or air agitation...in fact, without agitation should none be available. And all this plus high tolerance to organic and metallic contamination! You can switch over to NICKEL-GLEAM N222 without changing conditions under which you prefer to operate. You will get better results. A trial run will prove it.

NICKEL-GLEAM N222 is a product of Lea-Ronal Research Laboratory widely experienced in plating procedures and responsible for some of the most productive formulations being used today.

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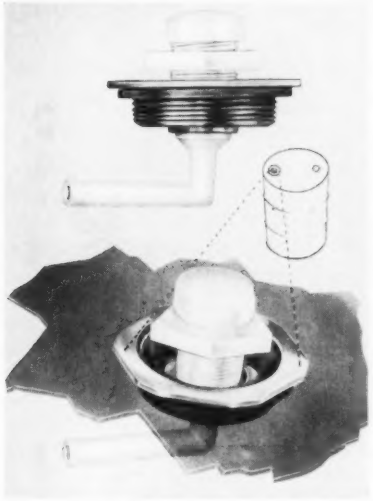
allowing the finger pressure to remain the same, regardless of pressure and flow being used. Long, straight orifice permits operator complete control of directing the air stream. Hook trigger guard serves as a finger safety guard and also designed as a handy hanging device. The gun is made of aluminum and balanced so that it will hang in an upright position on most any machine edge, keeping gun within easy reach.

The valve is a simple cam action mechanism with a Teflon seal which may be easily and economically replaced. Ten inch extension nozzles, for hard-to-get-at places are available in both straight and curved end design.

Drum Vent

Plastiline, Inc., Dept. MF, 2 Intervale St., White Plains, N. Y.



A plastic drum vent, designed to eliminate costly waste and damaging spillage, is contructed to allow smooth liquid flow, and is engineered to eliminate liquid evaporation and contamination.

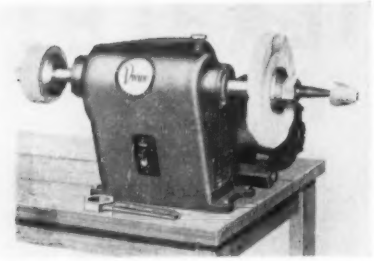
Adaptable for ¾ inch or 2 inch faucet openings, the vent is easily installed when the drum is ready for use. Fitted with tapered pipe thread for adjustment, the drum vent has a directional arrow indicator to insure the vent is properly located in drum's air space.

Made of polyethylene, the drum vent is non toxic. Durable construction insures long and continuous use.

Bench Lathe

Divine Bros. Co., Dept. MF, Seward Ave., Utica, N. Y.

The VR lathe is designed for mount-



ing either on a bench or on the LP Pedestal, which is dimensioned to provide correct spindle height for average use. It is furnished with holes for lagging to floor and bolting lathe to the top surface. Of the four models of the lathe, three of them — VR 1, VR 1½ and VR 2 — are equipped with a single V-belt drive, while Model VR 3 is driven by two V-belts. V-belt drives on all models are enclosed by a metal guard. Because of its wider selection of speeds and simplified maintenance, the V-belt drive offers distinct advantages over direct driven bench lathes. In addition, numerous spindle arrangements are possible for use on special jobs.

Any of the following speeds may be selected for all the models: 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3100, 3600 and 4000 rpm. Two and three speed drive can be supplied for a slight additional charge. The heavy spindle runs in two sealed-for-life ball bearings, which need no lubrication, while a handwheel controls the V-belt tension, simplifying the changeover from one speed to another.

The lathe can perform abrasive belt polishing. In fact, it is heavy enough to handle two bench backstand units, it is claimed.

Vinyl Wrinkle Finishes

Union Carbide Plastics Co., Dept. MF, 30 E. 42nd St., New York 17, N. Y.

The first wrinkle finishes based on vinyl plastisols, organosols and solutions provide unique decorative effects as well as the resistance and durability characteristics of Bakelite vinyl resin-based coatings.

An important ingredient in the new finishes is Monomer MG-1 which, in addition to a select combination of driers and polymerization catalysts, is largely responsible for the development of the wrinkle pattern. The polymerizable plasticizer is also familiar as a plastisol modifier used to produce extremely rigid type plastisols.

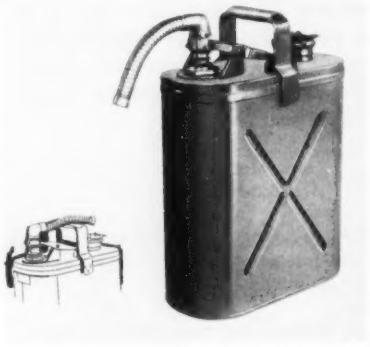
Conventional enamel or lacquer guns may be used to spray organosol wrinkle finish. Wrinkle finishes made from organosols are similar in properties to those made from plastisols because the same type vinyl-based resin is used.

The major advantage of solution coatings is that finishes may be prepared using lower temperatures in the baking schedule than is possible with either plastisols or organosols. In formulation, solution vinyl wrinkle coatings are quite different from plastisols and organosols. The solution coating closely follows the principles of general solution vinyl coating formulation.

5-Gallon Safety Can

Protectoseal Co., Dept. MF, 1920 So. Western Ave., Chicago 8, Ill.

New oval shape makes a more compact container, requires far less storage space, and is much easier to handle and use. Five oval shape cans are easily stored in storage cabinets and safety vaults in the same area required for



three of the customary round safety cans.

A flexible metal pouring spout eliminates hazardous spillage when dispensing, and permits filling of containers with small receiving openings without waste. The spout swivels to a "tuck-away" position over the can body when not in use, to save additional space and permit cans to be placed close together. It carries easily in a natural close-to-the-body position and handles without effort when dispensing.

All seams are lap-joined and then electrically seam welded into a single leak-proof container; terne plate construction provides for inside and out lead-coating for greater resistance to corrosion. Sides of the can are debossed for added strength and a shock rim at the bottom raises the body from the floor.

The fill opening cap opens to a full 80 degrees to permit quick, unrestricted filling, and both fill opening and dispensing opening have perforated metal fire baffles to guard contents from ignition. The self-closing cap over the fill opening also supplies automatic vapor pressure relief.

Blackening Salt Remover

Heatbath Corp., Dept. MF, Springfield 1, Mass.

A new liquid product, known as No Bleed, for removing entrapped or absorbed blackening salts from powdered metal parts, eliminates or insures against conditions referred to as bleeding, blooming, flowering and weeping out that become visible and are objectionable on blackened powdered metal parts.

The material is used as received at a temperature of 240-250°F for 15-30 minutes. The powdered metal parts are then allowed to dry and are eventually re-oiled.

Drum Vent

Protectoseal Co., Dept. MF, 1920 S. Western Ave., Chicago 8, Ill.

Designed to provide complete protection for all 55-gallon steel drums with the 2" bung opening located in the head when drums are placed in a horizontal position for storage or dispensing, this new vent prevents drum rupture and loss of contents even in the extreme condition when drum is completely surrounded by fire.

Automatic pressure relief against interior vapor build-up is provided by an automatic valve which opens at 5 lbs. psi, to relieve interior pressure, and a fusible plug melts at 135°F. to provide quick emergency pressure relief in the event of fire.

The vent has an extra thick gasket seal which compresses when screwed into the threaded bung opening to secure a tight, leak-proof connection; pressure-vacuum relief passages are located above the full liquid level of the drum to insure against leakage. All

vent passages are covered by a perforated metal fire baffle to prevent propagation of fire and explosion into the drum.

A quick-acting manually operated vacuum relief valve provides for a full free-flow when withdrawing liquids.

Wet Film Applicator

Precision Gage & Tool Co., Dept. MF, 320 E. Third St., Dayton 2, Ohio.

A unique wet paint film applicator which gives eight different readings off a single instrument is available in two different models. Model #1, which is used in conjunction with "hiding power" charts, will lay down a film 2" wide in any of eight thicknesses from 0.001" to 0.008" in increments of 0.001". Model #2 will lay down a 2" wide film in any of eight thicknesses from 5 to 50 mils as follows: 5, 10, 15, 20, 25, 30, 40, and 50. This model can be used for checking latex films for toughness and flexibility.

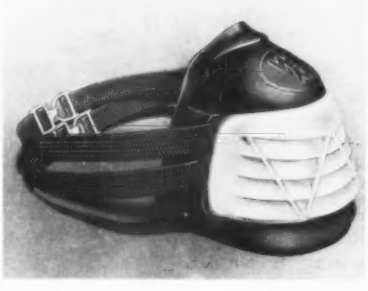
It is square in design and has four separate paths on each side. There are no adjustments to make on the device. A few drops of the material to be checked are placed on the inside of the hollow square near the correct opening for the thickness required. The applicator is then drawn down over the chart and a uniform thickness of film is presented for observation and test.

The applicator is made of a fine steel, glass-hardened, and treated to prevent rusting.

Respirator

Welsh Mfg. Co., Dept. MF, 39 Magnolia St., Providence 9, R. I.

A plastic respirator for protection against dusts, pneumoconiosis-producing mists, and chromic acid mists, with Bureau of Mines Approval 2175, weighs only 2.1 ounces, approximately half that of other leading respirators. The Air-Raider introduces a new respirator design providing greater functioning filter area which increases filter life. Unique valve construction and location reduce inhalation and exhalation resistance. Modified polyethylene material is nontoxic, resilient and durable. Frame cushion fits wide variety of face shapes and head sizes. Double headbands have four-point suspension providing a positive seal with minimum pressure. Filter is a performance proven, treated-wool electrostatic type.

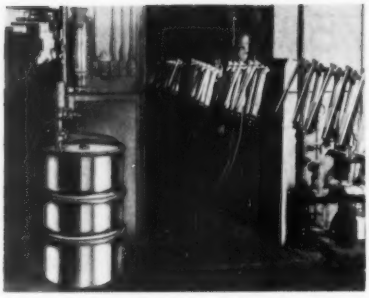


Eight parts are quickly and easily assembled without clips or fasteners.

Air-Powered Pump

Gray Co., Inc., Dept. MF, 1021 Sibley St. N.E., Minneapolis 13, Minn.

A new, air-powered pump dispenses unpigmented paints, primers, lacquers, etc., direct from 2" end bung of original shipping drums. This lightweight (only 17½ lbs.) Graco Powerflo pump will dispense up to 120 gallons per hour for normal circulating paint system operation and feed up to 5 spray guns. The pump is also ideal for direct supply spray applications in production and maintenance painting. Outlet pressure



is approximately twice that of inbound air pressure.

Unique, three-tube design completely separates air motor from pump assembly, thereby eliminating any chance of fluid fouling power head. Two tubes are used for supply, while the third tube returns paint to drum for continuous circulation.

Being air-powered, the pump is free from any sparking hazards. Adjustable bung adapter permits use in 55 gallon drums of varying height. The pump may also be mounted in open head drum, with use of a drum clamp, or on drum cover. The unit includes air regulator for governing pump operating speed.

Dry Chemical Fire Extinguisher

Ansul Chemical Co., Dept. MF, 1 Stanton St., Marinette, Wis.

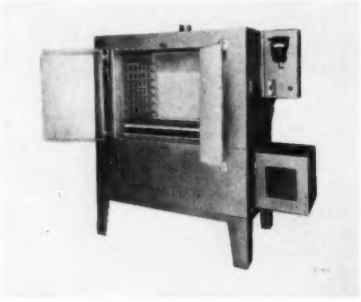
A new family of dry chemical fire extinguishers feature "fresh-fill" performance including maximum fluidization, absolute gas tightness and simpler operation. Four models comprise the "D" line: 5, 10, 20, and 30-pound capacities. They can be obtained in fire equipment red or in white for maximum visibility in any location.

Thirty-one product design and engineering improvements have been incorporated into the new models.

Cabinet Ovens

L & L Mfg. Co., Dept. MF, 290-8th St., Upland, Del. Co. of Penna.

New Cyclo-Flow cabinet ovens are made in both horizontal and vertical air flow styles. They are made in 500°F, 650°F, 850°F and 1000°F series. The ovens are equipped with standard features such as heating chamber air velocity control of from a minimum of 200 feet per minute to a maximum of 600 feet per minute, and indicating temperature controller, low watt density Super-Life elements, infinitely variable input controllers for matching heat input to load conditions, adjustable exhaust vents and intake inlets, fan shaft heat dissipators for bearing and motor protection, belt fan drive, manual interlock for purging or cooling without heat, and a unique air flow safety switch for positive protection in the event of motor, bearing or fan failure, explosion proof door latches, adjustable door hinges, asbestos tadpole type door seals, no radiant heat from the elements to the work chamber, even air flow across shelves.



The oven carries a one year guarantee. 1000°F models are constructed with all interior parts of stainless steel. Shelves are on 3" centers. Units are completely pre-wired for immediate installation.

Silk Screens

Crown Zellerbach Div., Marathon Metal Products, Inc., Dept. MF, 67 Huntington St., Cortland, N. Y.

Low cost silk screens for industrial application can be used for decorating objects with painted or baked surfaces such as name plates, ash trays, toys, TV set or chassis.

The manufacturer also has complete facilities for sub-contract screen painting.

Immediate delivery can be made on silk screens with 7 x 9", 10 x 13" or 13 x 16" maximum printing area; special sizes are available on request.

Medium Weight Plastic Gloves

Pioneer Rubber Co., Dept. MF, Willard, Ohio.

Made of Pylox material, the V-20 Stanflex model is ideal for jobs requiring finger sensitivity. The non-

binding design of the tapered fingers and roomy palms give barehand comfort to the wearer. The gloves can also be turned inside out so the textured inside finish can provide a non-slip grip sometimes required for special handling jobs. The new glove is resistant to alkalies and inorganic acids, oils, greases and some solvents.

Available in small, medium and large sizes, the new gloves offer ample wrist protection. Their non-allergenic properties make them ideal for persons allergic to ordinary rubber gloves.

Texture Coating

Universal Paint & Varnish Inc., Dept. MF, Bedford, Ohio.

An entirely new metallic texture finish, with unusual three-dimensional characteristics, has just been announced under the trade name Tri-Namic. This economical one-coat finish is available in a wide range of brilliant colors, features a consistency of pattern that practically eliminates rejects caused by variations in texture. It can be easily applied by any spray method to all production metals, many plastics,

wood, ceramics, etc. Air or bake drying insures excellent durability, high corrosion resistance and top gloss and color retention.

High Capacity Spray Nozzles

Bete Fog Nozzle, Inc., Dept. MF, 309 Wells St., Greenfield, Mass.

A new series of high capacity nozzles, called the "K" series, give finer break-up and are non-clogging. In their unique design, these new nozzles em-

ploy three separate orifices from each of which a jet impinges on a deflector plate. Here the jets are broken up and intermingled to form a full-cone spray.

It is claimed that the absence of internal parts make these nozzles practically impossible to clog. Due to the straight through flow there is less turbulence and higher nozzle efficiency resulting in finer break-up according to the manufacturer. Smaller size, lower cost, longer wear and greater choice of materials are other advantages claimed for the nozzles.

Made in seven standard models from 1½" to 8" pipe size, the series covers a flow rate range of 20 to 3,000 gpm.

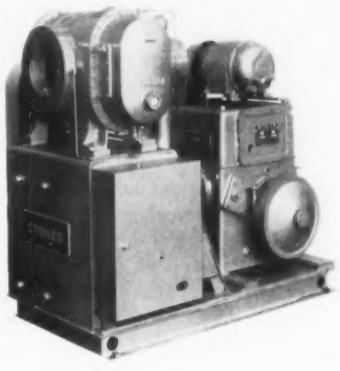
The nozzles can be supplied in cast iron, bronze, stainless steel or other materials and the deflector plates can be supplied in wear resistant materials including hardened steel, stainless steel, Hastelloy, Monel, etc.

Mechanical Booster Vacuum Pumps

F. J. Stokes Corp., Dept. MF, 5500 Tabor Road, Philadelphia 20, Pa.

A new series of pumps operate at faster pumping speeds in the pressure range from 10 microns to 1 millimeter than comparable units offered by other manufacturers, and are thus capable of handling large volume pumping loads in this range more economically than other equipment, it is claimed. Model 1710 has a maximum pumping speed of 1050 cfm. and is capable of an ultimate vacuum below ½ micron. Other units in the new series are Models 1711, 1712, and 1713, with maximum pumping speeds, respectively, of 1250, 2900, and 5100 cfm. Larger units, with capacities up to 10,000 cfm., are currently under development, according to the company.

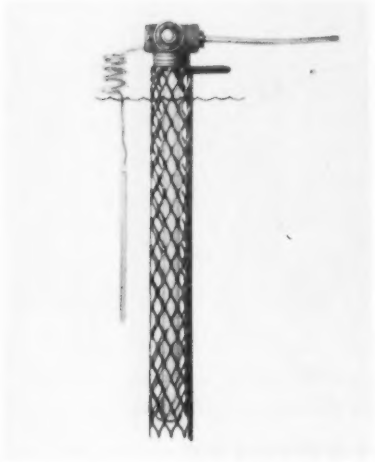
The new mechanical booster pumps are integrated two-stage pumping systems, built together compactly on a common base-plate. First stage is a Roots-type dry blower (with two inter-meshing bi-lobed impellers) that acts as a supercharger for the second stage, a standard gas-ballasted Microvac rotary vacuum pump of the appropriate size. During initial rough pumping, the Microvac pump operates by itself. At the proper cut-in pressure, the blower commences pumping and the whole assembly becomes a two-stage pump of tremendous throughput and high vacuum ability.



Electric Immersion Heaters

N. J. Thermex Co., Inc., Dept. MF, 533 Bergen St., Harrison, N. J.

A new line of immersion heaters introduces a completely new vapor venting system to eliminate internal explosion in quartz heaters, called Vapo-



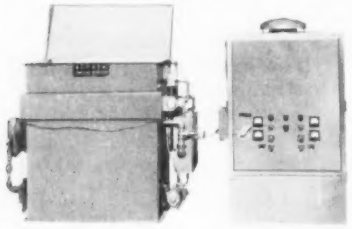
Vent. The assembly provides a system for venting expanding gases in a completely liquid sealed head assembly.

In addition, Therm-X-Red heaters feature the Neo-Tite, a vapor and liquid tight assembly which protects both quartz and steel heater units from damage by accidental total immersion in highly corrosive chemicals.

Ultrasonic Degreaser

Detrex Chemical Industries, Inc., Dept. MF, Detroit 32, Mich.

The new 1288 Soniclean degreaser, with the use of high frequency (400 kc) and stabilized trichlorethylene, is said to condition work to sufficient cleanliness that inspection under a



high-power wide field binocular microscope will discern no soil of any kind.

With the addition of adequate quantities of clean distillate, augmented by 2 micron filtration of the sonic chamber, this process is said to provide a production cleaning method eliminating tedious and costly hand cleaning.

Acid-Resistant Flooring

Stonhard Co., Inc., Dept. MF, 1304 Spring Garden St., Phila. 23, Pa.

A new flooring material which can withstand up to 50% inorganic acid conditions without corroding, called Stonclad, will also withstand hot concentrated alkaline solutions up to 170°, nitric acid up to 15%, and will resist highly concentrated sulphate solutions, it is claimed. Main feature of the flooring is its ability to resist corrosion damage from acids and alkalies and at the same time stand up under extremely heavy traffic.

Trowel applied, the product is packaged in three ready-mix parts which are combined at the job site. Under normal conditions the mixture will remain workable for more than an hour. A new installation may be used for foot and light truck traffic after five hours.

One unit applied at 1/8" thickness will cover 75 sq. ft. A unit costs $65 in quantity f.o.b. Philadelphia and Toledo.

In most cases no special floor preparation is required. Simple cleaning is usually sufficient preparation before application of the product over the old surface. Nor is there any need to remove machinery. The product can be formed, and bonds tightly, to the base parts of equipment.

Available in two pleasing colors, tile red and medium grey, the product dries to a pleasing satin finish, either smooth or non-skid.

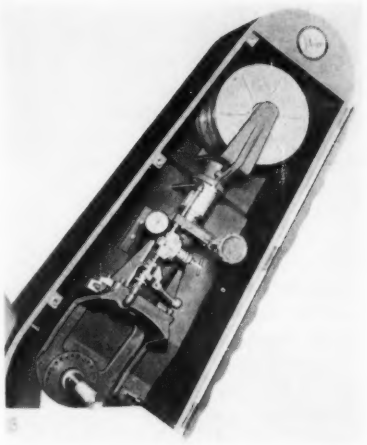
Belt Polishing Attachment

Divine Bros. Co., Dept. MF, 200 Seward Ave., Utica, N. Y.

Model DL air-operated abrasive belt attachment converts any polishing and buffing head unit or lathe to accommodate abrasive belts in addition to wheels and buffs. When used with abrasive belts, a contact wheel is mounted on the head or lathe unit spindle and the abrasive belt is placed over this contact wheel and the idler pulley of the attachment.

Desired air pressure is set by means of the regulator and gage. The air control valve is then moved to the right and the belt is immediately tightened to the pre-set tension. This tension is accurately maintained regardless of work pressure or belt stretch. To release the belt for storing or changing, the air control valve is simply moved to the left and the belt is immediately slackened. The belt tracking control knob extends through the hood cover for convenience in adjusting when the hood cover is closed. The mounting bracket attaches around the spindle housing of the machine.

The belt is available in widths from 6" to 10" and is 120" long. Contact wheels of 12", 14" or 16" may be



used, and contact wheels of any desired density or construction can be furnished with this attachment.

The dust hood, which is optional, is 58" long, while the net weight of a 6" belt is 180 pounds. Mountings are available for all models. The attachment, which can be operated at any convenient angle, comes with an airline filter and lubricator.

Canvas Tote Baskets

Handy Folding Pail Co., Inc., Dept. MF, 17 Thompson St., New York 13, N. Y.

Specially designed, exceptionally durable, canvas tote baskets are light in weight, easy to carry and can be nested inside one another without sticking, for storage in a small space.

Made in two sizes — 17 x 10 x 7" deep weighing 18 oz., and 20 x 12 x 8¾" deep weighing 24 oz., the baskets are durable; vat-dyed, water repellent Army duck over a tinned wire frame, with a completely washable plasticized canvas bottom. The strongly riveted double canvas handle is balanced so that the basket will not tip or become

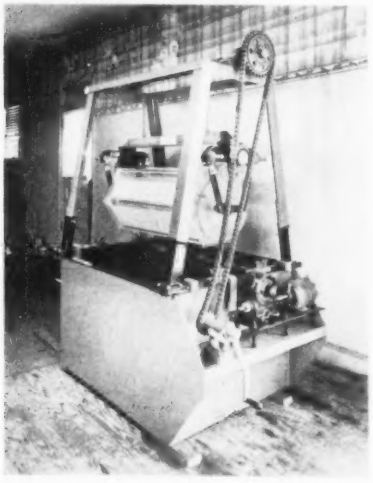
unwieldy when lifted with one hand.

These tote baskets may be had in royal blue or bottle green from stock, other colors on special order. They are priced at $2.75 each for the small size and $3.75 each for the large size. Discounts are offered on large quantities.

Plating Barrel

Nu-Lite Plating Equip. Co., Dept. MF, 73-32 Calamus Ave., Woodside 77, N. Y.

This new acid-proof horizontal plating barrel is designed and constructed to withstand any type of plating solutions. Parts are easily and quickly replaced. The high-temperature Plexiglas cylinder is custom made, every panel



is cut to size and double fused for double protection, to give longer life under roughest conditions. The hangers are made of Plexiglas or glass-melamine with removable Haveg bearings. The upper part of the hangers are heavy castings, coated with heavy plastisol.

Flexible bull-nose stainless steel dangler contacts are removable from inside of cylinder. Idler gears are stainless steel, ring gears are Plexiglas, Tempron or glass-melamine. Anode bars are removable, and all plating units are guaranteed against defects in workmanship and material for 18 months.

Sand Blaster

A. L. C. Co., Dept. MF, 646 Oak St., Medina, Ohio.

The new low-cost Sandy Jet "Spot" Blaster, according to the manufacturer, quickly and easily cleans rust, paint, carbon, dirt, and weld scale right down the bare metal.

The blaster operates on an average compressor at 100 to 185 lbs. pressure. No separate blast room is required — just a cardboard keeps the abrasive confined. The tank holds 12 quarts of abrasives such as low-cost silica sand, metal shot, nut shells, and aluminum oxide. For cleaning engines and parts, liquid detergents may be used.

The unit sells complete, with extra nozzle, at $29.95.

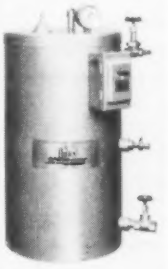
Work Order Tube

A. E. Maybrun Co., Dept. MF, 920 Ripley St., Santa Rosa, Calif.

A new solution to the problem of keeping the job order with the job through plating, pickling and finishing operations, the "Work Order Tube" is fabricated of high temperature polyethylene and is guaranteed to keep the work order safe and dry through acids, steam, water, paint, or extremes of temperature. The tube measures $1\frac{1}{8}$" ID with $8\frac{1}{2}$" inside length, is sealed by a single turn screw cap on an O-ring washer seal at bottom of cap for complete moisture-tightness. As the polyethylene is not affected by most known reagents and will not adhere to paint, the tube is simply unhooked and wiped clean after use and re-used indefinitely. For color coding, to key jobs to destinations or relate them to major assemblies, the tubes may be ordered in any color or any combination of cap and body colors.

Electric Steam Generator

Pantex Mfg. Corp., Dept. MF, P. O. Box 669, Pawtucket, R. I.



For plug-in operation on 110-115 volt AC circuits, Speedylectric Series R utilizes a completely new conception of electric steam generation, featuring the simplicity, safety and self regulating characteristics of the electrode boiler plus the advantage of the fixed overload control inherent in resistance element heating.

Identified by the manufacturer as Catalog No. 15R1-1 — this efficient little unit generates 6 lbs. of steam per hour at pressures up to 15 psig (250°F). For 220 volt single phase operation, Catalog No. 15R2-1 pictured, generates up to 17 lbs. of steam per hour.

BUSINESS ITEMS

Mahoney Appointed Pangborn Sales Engineer

J. A. Mahoney

Pangborn Corp., Hagerstown, Md., manufacturers of abrasives, blast cleaning and dust control equipment, have announced the appointment of *John A. Mahoney, Jr.*, as sales engineer. He will be headquartered at the Philadelphia district office, 806 West Ave., Jenkintown, Pa.

Mahoney was previously associated with Reeves Pulley Co. in Philadelphia as a sales engineer. A Navy veteran, he attended Notre Dame University.

Turco Building New National Headquarters

Turco Products, Inc., manufacturer of industrial chemical processing compounds, has broken ground in Wilmington, Calif., 20 miles south of Los Angeles, on a 66,000 square foot, million dollar national headquarters. The new facility, scheduled for completion next summer, consists of an administration building and executive wing, a research center and an engineering service building. It will be contiguous to the firm's modern "push-button" manufacturing plant, which was built on the site some three years ago.

DuBois Opens New Jersey Plant

Formal dedication and open house for the new *DuBois Co., Inc.* manufacturing plant at East Rutherford, N. J., was on Wednesday, November 5, 1958. The Cincinnati based firm is nationally known as a manufacturer of institutional and industrial cleaning compounds.

The 53,022 square foot facility, costing over a million dollars, embodies many new ideas in materials handling, quality control and manufacturing and assembly techniques. The plant had been operating on a limited scale since July, 1958.

Enthone Adds To Staff

Hugh V. McGuire has been appointed assistant to the sales manager of *Enthone, Inc.*, New Haven, Conn. He will specialize in the marketing of the metal finishing equipment and accessories manufactured and distributed by the equipment department.

Hugh V. McGuire

Kenneth D. Miller

Mr. McGuire is a graduate of Rutgers University. He has been employed by the Jack S. Steele Co. of Philadelphia as manager of their Matawan, N. J. branch office and by Hanson Van Winkle-Munning Co. of Matawan, N. J., as manager of general equipment sales. Most recently, he headed up his own equipment engineering firm, McGuire Associates of New York City.

Kenneth D. Miller has joined the company as design engineer in the equipment department. He is a mechanical engineer and was formerly head of the electrical department of Mead-Morrison Division of McKiernan Terry Corp., Harrison, N. J. He comes to Enthone from Hanson-Van Winkle-Munning Co. where he was group engineer in the continuous equipment department.

Ebersole Appointed Federated District Manager

Robert H. Ebersole has been named district manager of the Detroit sales office of the *Federated Metals Division* of *American Smelting and Refining Co.*

Born in Muskogee, Oklahoma, in 1916, Mr. Ebersole spent four years as a pilot in the Army Air Force. He joined Asarco as a sales trainee for the Federated Division in 1945. Since 1955, he has been a sales representative in Detroit.

Mr. Ebersole attended Westminster College, Jefferson College, Purdue University and Washington University. He is a member of the American Foundrymen's Society and the Society of Die Casting Engineers.

New Raybestos-Manhattan Warehouse

Raybestos-Manhattan, Inc. announces the moving of its San Francisco district warehouse and offices from 131 Mission St. to new and larger quarters at 168 Beacon St., South San Francisco, Calif.

Nu-Lite Plating Moves

Tony Jeremicz, partner of *Nu-Lite Plating Equipment Co., Inc.*, manufacturers of plastic plating equipment, announces that the firm has moved to new and larger quarters at 73-32 Calamus Ave., Woodside 77, N. Y., telephone ILlinois 8-6400.

Barrett Appoints George H. Anderson & Associates

Leon J. Barrett Co., manufacturers of heavy-duty centrifugal equipment, announces the appointment of *George H. Anderson & Associates*, 205 West Wacker Drive, Chicago 6, Ill., as sales engineers in the Chicago, Northern Illinois and Northwestern Indiana territories.

Van Der Horst Announces Promotions

Van der Horst Corp. of America has announced the appointment of *Dr. Hyman Chessin* as director of research and development for the corporation.

Dr. Chessin was born in Cleveland, Ohio, in 1920. Graduate work in electrodeposition and electrochemistry at Western Reserve University, Cleveland, Ohio, led to the PhD degree in physical chemistry in 1951.

Teaching and research in electrodeposition at Kenyon College, Gambier, Ohio, and research at the Institute of Science and Technology, University

Dr. Hyman Chessin

Leo Alderuccio

of Arkansas, Fayetteville, Arkansas, was followed by the appointment in 1954 as assistant director of research for the company.

Dr. Chessin is a member of the AES, the ACS, The Electrochemical Society, the Electrodepositors' Technical Society, London; Sigma Xi and Sigma Pi Sigma.

Named to assume the post of assistant director of research and development is *Lee Alderuccio*, M.S., St. Bonaventure University, 1950. Mr. Alderuccio first joined the corporation in 1954 as a research electrochemist.

Schaffner Mfg. Co., Inc. Elects James R. Schaffner Sec'y-Treas.

Schaffner Mfg. Co., Inc. announces the election of *James R. Schaffner* to secretary-treasurer of the corporation. After completing an extensive research program, he was assigned to sales under the direction of *Paul E. Schaffner*. He will continue his interest in sales

James R. Schaffner

Peter J. Verlinich

together with his new responsibilities.

Also announced was the appointment of *Peter J. Verlinich* as director of public relations. Mr. Verlinich was formerly associated with Rockwell-Standard Corp. for twenty-two years, in the capacity of supervisor in the finishing of ferrous and non-ferrous metals and is thoroughly conversant with the finishing processes.

New Service Announced by Armour and Co.

A nation-wide automotive coated abrasives technical advisory service has been announced by the Coated Abrasives Division, *Armour and Co.*, Alliance, Ohio. This new and outstanding service is available at no charge to automotive plants throughout the nation.

This new service will be designated as the Automotive Section of Armour Technical Service and it will be staffed by abrasive engineers who have had practical experience in automobile production and who have specialized in automotive coated abrasive application problems.

Enthone Named Exclusive Distributor for Abbey Process

Abbey Process Automation, Inc. of Long Island City, New York has announced the appointment of *Enthone, Inc.* of New Haven, Conn., as exclusive distributor. The agreement covers that portion of the United States east of the Rocky Mountains. Enthone is also authorized to sell Abbey equipment on a non-exclusive basis in the remainder of the United States and in Canada.

The two firms will pool their engineering talent in applying the automation system to plating and finishing installations. The conveyors will be built at the Abbey plant while tanks and accessory equipment will be manufactured at Enthone.

Erik Van Anglen Appointed by Atlas Mineral

Atlas Mineral Products Co., subsidiary of *Electric Storage Battery Co.*, has announced the appointment of *Erik Van Anglen* as district sales manager for the New York sales territory, which includes Metropolitan New York. The New York office is at 475 Fifth Ave., New York 17, N. Y. Telephone MUrray Hill 3-1868.

Mr. Van Anglen was promoted from his position of technical sales representative in the Philadelphia sales territory, where he served for five years. He will handle the complete line of corrosion proof construction materials, including cements, linings, protective coatings, monolithic flooring materials, foamed-in-place plastics and rigid plastic pipe, fittings and structures.

Rohco Opens Detroit Warehouse

R. O. Hull & Co., Inc. recently opened a Detroit sales office and service laboratory at 3136 Hilton Road, Ferndale, Mich., to supply Detroit, Toledo and the southeastern Michigan area.

The new district office offers analytical laboratory and warehouse facilities to handle Rohco plating specialties, and will also carry a complete stock of Enthone and related plating chemical supplies.

Herbert Geduld, former Detroit representative, is district manager. *Joe Manzella*, formerly with the Peninsular Laboratory, is appointed technical re-

Herbert Geduld

Joe Manzella

Glenn Berger

John S. McElwain

Ed Moor

presentative. *Glenn Berger*, formerly with the firm's Cleveland laboratory has been appointed analytical chemist.

Roto-Finish Appoints Distributor

Abrasive Specialists of Milwaukee has been appointed Wisconsin distributor for *Roto-Finish Co.* The new distributor covers the entire state of Wisconsin and employs a staff of six sales representatives. In addition to barrel finishing equipment and materials, Abrasive Specialists handles a complete line of grinding wheels, diamond tools and grinding coolants for the industrial metal-working trade.

Modern warehouse facilities, located in Milwaukee, make possible adequate distributor stocks and prompt customer delivery service.

Steinberg Retires After 41 Years

William H. Steinberg, technical consultant and recently sales manager of the Abrasive Wheel Department, retired after 41 years with the Manhattan Rubber Division of *Raybestos-Manhattan, Inc.*, Passaic, N. J.

He started as a development engineer in the department in 1917. Previously he had been with the Cutler-Hammer Co. in Milwaukee. He became sales manager some time later.

Mr. Steinberg has no immediate plans for his retirement for the present but his principal hobby is fishing from his Lake Champlain camp.

McElwain Head of New Van Dorn Division

Establishment of an Infra Red Division has been announced by *Van Dorn Iron Works Co.*, Cleveland, Ohio. *John S. McElwain* was named division sales manager and head of the division.

An infra red heater which operates on natural, propane, or manufactured gas will be available soon for hundreds of applications.

H-VW-M Sets Up Plastisol Shop

Hanson-Van Winkle-Munning Co. is now applying plastisol coatings to plating equipment it manufactures at its plant in Matawan, N. J. The announcement said that operation of new facilities for this purpose results in reduced delivery time on coated equipment and reduced total cost to the customer.

In addition to coating equipment that it manufactures, the company is also taking orders for custom coating of plating equipment. The new facilities enable the firm to perform all related operations, including sandblasting, priming, preparatory baking, coating by both spray and dip processes, and final baking after application of the plastisol.

Tanks, racks, exhaust hoods and duct work will be treated, as well as auxiliary equipment such as cathode rod insulators, screens used for protection of air agitation equipment, diaphragms, pipe and flange pipe fittings, fans, and stirrers.

Ed Moor Joins International Rectifier

In line with a current sales organization expansion program, *International Rectifier Corp.* has announced the appointment of *Ed Moor* as rectifier field engineer in the New York area.

Mr. Moor attended Newark College of Engineering, and was a component sales engineer in the New York area before joining the company.

Federated St. Louis Office Moves its Headquarters

The St. Louis Sales office of the Federated Metals Division of *American Smelting and Refining Co.*, has moved from its former location at 4041 Park Ave. in St. Louis to the company's new plant at Alton, Ill.

The new office will continue to be under the direction of *C. R. Kenner*, district manager. The address at Alton is P. O. Box 268, Alton, Ill. The new telephone number is Alton 5-2511.

American Instrument Opens New Sales Offices

American Instrument Co. of Silver Spring, Md., has recently opened new sales offices in Murray Hill, N. J.; Long Island, N. Y.; Cleveland, Ohio; Detroit, Mich.; Denver, Colo.; and San Francisco, Calif. These offices have been staffed with highly trained sales engineering personnel.

Jack Kertzman, a graduate of New York University in chemistry, has been appointed to the Murray Hill, N. J., office. He obtained his M.S. degree in chemistry in 1951.

W. C. Weaver and *E. M. Becker* now operate the Manhattan-Conn. office. Aminco is represented in Long Island, New York, by *James J. O'Connor*.

Assigned to the Cleveland office is *W. Donald Finn*. Mr. Finn was formerly a development engineer with Koppers Co., Pittsburgh, Pa. He received his degree in chemistry from the University of Pittsburgh.

James A. Fitzsimmons, who opened the Detroit office early in November, attended St. Michaels College where he majored in biology.

Representing the Denver office is *Charles R. Jent.*

Northern California's new sales engineer is *Herman C. Zwart.*

The Atlanta office, which formerly served the States of Georgia, Alabama, and Tennessee, has now been expanded to also service the western part of North Carolina, South Carolina, and Florida. *Hugh Pearson*, whose office is in Jacksonville, Fla., services the Florida area exclusively.

Enthone Absorbs Comco Subsidiary

Enthone, Inc., of New Haven, Conn., a subsidiary of American Smelting and Refining Co., has announced that, effective January 1, 1959, it has taken over and continues in its own name the business of its wholly owned equipment subsidiary, *Comco, Inc.* Comco's manufacturing facilities will be integrated with Enthone's and operate as the latter's equipment department. *J. J. Martin, Jr.*, general manager of Comco, has been appointed general manager of the new department.

This change, it is stated, will facilitate expansion of the company's equipment business, previously confined to the northeastern U. S. area, to the entire country.

Promotions at Almco

Almco, Queen Products Division, has announced a number of promotions. *Don Johnson* is now sales manager. He has managed the Detroit branch operations the past three years, and before

Don Johnson

Al Sartor

Bruce Hardin

this was district manager in the Illinois-Wisconsin area, and sales engineer in the Minnesota-Iowa-Missouri area, before the Chicago assignment. Don will be located in Albert Lea, and will assume direct supervision of the field sales operations, as well as dealer services.

Al Sartor is branch manager of the Detroit operation, servicing Michigan, Ohio, Indiana, and Western Pennsylvania. He has serviced the Michigan area as sales engineer the past five years. The branch is located at 7495 East Davison, Detroit, Mich.

A promotion also for *Bruce Hardin*, to sales engineer of the Michigan area. Bruce has served the company as sales co-ordinator the past year. He will reside in Detroit.

George Shelson is the new sales coordinator. He has been associated with the firm for the past 6 years as ass't. chief engineer and will have direct supervision of the office in Albert Lea.

Lea-Ronal Secures Injunction Against Smoothex

Lea-Ronal Inc., Jamaica, N. Y., developers of electroplating processes, and its associate company, *Elechem Corp.*, Jersey City, N. J., have secured an injunction against *Smoothex Inc.*, Cleveland, Ohio, and *Platers Research, Inc.*, of New York in a patent infringement suit based on violation of Lea-Ronal's Patent 2,732,336 for bright copper plating.

The decree adjudged the patent to be valid and infringed upon by Smoothex Inc., which was enjoined from directly or indirectly manufacturing, using, and selling products coming within the scope of the patent.

As liquidated damages Smoothex assigned to Lea-Ronal its trademark "Smoothex," together with the associated good will and business. In addition, Smoothex assigned to Elechem Corp. its Patent 2,814,590 relating to bright copper plating.

The decree and injunction was signed by the U. S. District Court, Southern District, New York, on November 17th, 1958.

Wagner Appointed by Pangborn

The appointment of *Leonard W. Wagner* as Augusta district manager has been announced by *Pangborn Corp.*, Hagerstown, Md., manufacturers of abrasives, blast cleaning and dust control equipment. In his new position, Mr. Wagner will direct overall sales activities and field engineering services from the district headquarters at 1317 Buena Vista Road, Augusta, Ga.

Leonard W. Wagner

Mr. Wagner is a veteran of many years in the blast cleaning and dust control fields with the company, starting as a stenographer and serving in various sales department positions in the home office until 1926, when he became a sales engineer in the Detroit district. He was promoted to Chicago district manager in 1932 and has served steadily in that capacity until the present change.

White Named District Sales Manager for Robertshaw-Fulton

Appointment of *William H. White* as district sales manager has been announced by Fulton Sylphon Div., *Robertshaw-Fulton Controls Co.* His territory covers the upper half of New York State and northern counties of Pennsylvania. He will be in charge of sales of the company's metal bellows and bellows devices, valves, regulators and temperature controls in that area, and his offices are located at 797 Military Rd., Buffalo.

William H. White

Mr. White joined the firm in 1956 as sales engineer in the Syracuse, N. Y., territory. He later was transferred to the company's Buffalo office.

Prior to joining the organization, Mr. White served as sales engineer for a number of industrial companies in the New York area. He is a graduate of the United States Merchant Marine Academy, Kings Point, N. Y., and attended the University of Buffalo as a major in engineering. He is a member of the Instrument Society of America.

Former Esso V.P. Joins Prufcoat Laboratories Inc.

Russell N. Keppel, formerly director and vice president in charge of marketing for Esso Standard Oil Co., has joined *Prufcoat Laboratories, Inc.*, as vice president.

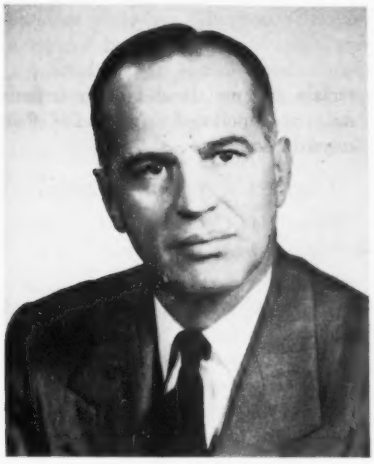
Mr. Keppel, who will make his headquarters at the firm's New York City sales office, has exceptionally broad experience in both domestic and overseas marketing. In addition to having been responsible at one time for Esso's 18-state marketing operation, he also had general supervision of all phases of marketing for Standard-Vacuum Oil Co. in 50 overseas countries.

A law graduate of the University of Buffalo, Mr. Keppel also attended N.Y.U., Columbia and Harvard where he studied business administration and management. He began his petroleum industry career in 1920 with the employee relations department at Esso Standard's Bayonne Refinery. During subsequent years, he played a prominent role in marketing development, cost reduction, and sales promotion.

Elections at Pfaudler Permutit, Inc.

Mercer Brugler has been elected chairman of the board of *Pfaudler Permutit Inc.* and *Donald A. Gaudion* has been elected president of the company. Brugler was continued as chairman of the executive committee, a position he has held for a number of years.

Coincident with these elections, the board of directors approved the appointment of *C. Wendell Beck* as general manager of the Pfaudler Division.



Mercer Brugler

succeeding Gaudion, who has been acting in that capacity. Beck was previously assistant general manager of the division.

These new designations became effective January 1, 1959 at a time when the present chairman of the board, *H. W. Foulds*, retired from active service. He is retaining membership on the board.

Gaudion, 45, a graduate of the University of Rochester and of the Harvard Graduate School of Business Administration, joined Pfaudler in 1948 as assistant to the president. Elected to the board of directors in 1951, he became vice president in charge of sales and advertising in 1952 and was named executive vice president in 1955. Prior to joining the company, Gaudion was with Eastman Kodak Co. 7 years and with Kryptar Corp. for 3 years.

Beck is 38 and a graduate mechanical engnieer from Swarthmore College. Before coming to the firm in 1955 he had 11 years experience in management and administrative work, rising to executive vice president, with the J. M. Lehmann Co. Inc., a machinery manufacturing concern in New Jersey.

Donald A. Gaudion

Manufacturers' Literature

Electropolishing Solution

MacDermid, Inc., Dept. MF, Waterbury, Conn.

Electro-Gleam 55, a liquid acid solution that produces a bright, smooth surface on stainless steel, aluminum alloys, and low and high carbon steels, is fully described in Technical Data Sheet No. 81, a three-page usage and instruction sheet.

Anodes and Plating Chemicals

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A new eight-page, two-color bulletin, AC-111, describes a complete line of anodes and plating chemicals. Illustrated by photographs and line drawings are a wide variety of anodes, anode hooks and anode bags. Details are set forth as to composition, shapes and specific application. Specifications are given for round, flat, elliptical, and specially shaped anodes, including nickel, cadmium, brass and bronze, copper, zinc, and lead. Also described are the new Lo-Sludge nickel anodes.

The bulletin discusses the criteria

for anodes, with emphasis on suitable metallurgical structure to promote even and uniform corrosion with minimum sludge formation, purity, chemical composition, and conformation for exposure of maximum active anode area per pound.

Spray Decorating Equipment

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A complete data file covers spray equipment, including electroformed nickel and copper masks, mechanical and air operated clamps and pressure fixtures, automatic mask washers, and automatic spray decorating machine.

Cooling Coils

American Air Filter Co., Inc., Dept. MF, 215 Central Ave., Louisville 8, Ky.

Bulletin No. 880 contains complete cooling coil selection information as well as detailed descriptive information on the coils themselves. Included, in addition to more than twenty photograph illustrations, are construction specifications, dimensional data, surface charts, circuiting diagrams, etc.

Electric Strip Heaters

Edwin L. Wiegand Co., Dept. MF, 7500 Thomas Blvd., Pittsburgh 8, Pa.

Bulletin F-1613, which illustrates the line of Chromalox electric strip heaters, contains thirty-two illustrations which show how this type of heater is used in industry.

The bulletin also contains a chart which outlines the wide range of sizes, wattages, sheaths and special features available for almost 500 standard models of eleven basic strip heater types.

Heating and Cooling Coils

American Air Filter Co., Inc., Dept. MF, 215 Central Ave., Louisville, Ky.

Included in Bulletin No. 890, in addition to more than twenty illustrations, are construction specifications, dimensional data, surface charts, circuiting and piping diagrams, etc., for standard steam coils, steam distributing coils, and hot water coils. Eight pages of temperature rise charts are given, as are face velocity charts, altitude and temperature correction charts, steam-pressure-and-temperature correction-factor chart, and condensaterate tables.

Four pages are devoted to selection information on hot water coils. A complete selection example is given. Tables and charts included in this section are as follows: mean-temperature-difference chart, heat-transfer-factor chart, water-velocity and pressure-drop tables for both standard and cleanable-tube coils.

All water coils may be used for both heating and cooling. Cooling capacity information is obtainable by referring to the cooling coil bulletin (No. 880).

Epoxy Resin Finish

D. J. Peterson Co., Dept. MF, Sheboygan, Wis.

Properties of "Poly-Ep," a polyamide-epoxy resin finish, including dielectric strength; resistance to moisture, abrasion, organic and inorganic chemicals; adhesion to synthetic materials and metals and other technical data are included in bulletin #82-A recently issued.

Controlled Volume Pumps

Milton Roy Co., Dept. MF, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

Bulletin No. 258 describes a new line of Milroyal controlled volume pumps with totally enclosed drives. This bulletin describes the design features of the pumps and tells how they work, as well as providing specifications.

Overhead Cable Conveyors

E. W. Buschman Co., Dept. MF, Clifton and Spring Grove Aves., Cincinnati 32, Ohio.

Complete details on the extensive applications of Bush-Lock universal overhead trolley cable conveyors are offered in a new fully-illustrated 4-page bulletin, 40A, which describes a comprehensive selection of standard stock components available with the conveyor, and how they can be customized into a highly efficient overhead trolley system for a wide variety of functions and industries.

Components shown include cable, trolleys, tracks, drives, turns, idlers, gap sheaves, curves, quick-dip units, take ups, hooks, and lubrication facilities. All are illustrated individually for closer inspection, as well as in sample functional layouts to show the simplicity and low cost in assembling a cable conveyor system.

Mounted Abrasive Wheels

Chicago Wheel and Mfg. Co., Dept. MF, 1101 W. Monroe St., Chicago, Ill.

A new two-color Bulletin, No. 1505, shows all mounted wheel illustrations in full size, with exact dimensions and prices. There are 200 standard sizes and 86 standard shapes in a variety of bands, including vitrified, resinoid and soft rubber polishing.

Dust Collector

Joy Mfg. Co., Dept. MF, Oliver Bldg., Pittsburg 22, Pa.

A new 12-page, two color bulletin details the Microdyne dust collector, a wet inertial type dust collector installed as part of the duct and only one-tenth the size of other collectors of comparable performance.

Bulletin J-616 is illustrated with more than a dozen photographs of various installations throughout the country. It contains performance curves, complete specifications, accompanying cutaway drawings of the inner construction, as well as a description of a related filter for reclamation or removal of the collected slurry.

Carbon and Graphite

Stackpole Carbon Co., Dept. MF, St. Marys, Pa.

A new 56-page manual gives detailed property, application, and performance data on a wide range of carbon and graphite products. Complete even to showing how carbon and graphite are made, the manual also describes how the basic qualities of the carbon atom form the basis for different carbon and graphite grades.

Detailed application information for a number of mechanical, chemical, electrical, and refractory uses are described and illustrated throughout.

Grinding Wheel Safety Booklet

Grinding Wheel Institute, Dept. MF, 2130 Keith Bldg., Cleveland 15, Ohio.

This booklet discusses, in layman's language, such technical subjects as maximum peripheral speeds, strength classification of grinding wheels, definitions of maximum speeds, the effect of wheel speed on grinding action, safety guards, mounted wheels, proper mounting procedures, truing and dressing, and the do's and don'ts for safe grinding. It also contains a handy table for the operator's use in converting revolutions per minute (r.p.m.) to surface feet per minute (s.f.p.m.).

Safety Clothing

Milburn Co., Dept. MF, 3246 E. Woodbridge, Detroit 7, Mich.

A six-page booklet offers comparison of chemical resistance and safety factors of nine families of synthetic fabrics and films available in safety clothing. Resistances to inorganic and organic acids, alkalies, salts and solvents, at varying concentrations and temperatures, are enumerated for Dynel, Orlon, Dacron, Acrilan and vinyl-coated fabrics, and for vinyl and polyethylene films.

Vibrating Bulk Finisher

Lord Chem. Corp., Dept. MF, 2068 S. Queen St., York, Pa.

A 12-page, 3-color bulletin describes a new method of precision finishing, using three-way vibratory action.

The bulletin is illustrated by 25 "before and after" photographic reproductions of products finished by this new method.

Temperature Control

Partlow Corp., Dept. MF, New Hartford (Utica), N. Y.

A four-page folder on the applications of temperature controls features the newly introduced pneumatic controls, which are ideal for the rough tests of plating rooms with their corrosive atmosphere and the need for close tolerances and constant control.

Also described are electrical controls, both non-indicating, indicating and recording, plus a line of thermally operated gas controls and thermometers.

Epoxy Spray Coat System

Union Carbide Plastics Co., Dept. MF, 30 E. 42nd St., New York 17, N. Y.

A three page technical bulletin describes a new method of spray-coating 100 per cent reactive systems based on Bakelite epoxy resins that results in curing speeds suited to application requirements.

Technical Release No. 45 explains the simplicity and flexibility of the new systems and how they are expected to reduce both high labor costs and application limitations inherent in conventional methods of applying 100 per cent reactive surface coatings.

Rust Index of United States

Rust-Oleum Corp., Dept. MF, 2799 Oakton St., Evanston, Ill.

A Rust Index of the United States, listing the different rates at which metal rusts for each of 523 U. S. cities throughout the country, has just been published.

Ultrasonic Cleaners

Narda Ultrasonics Corp., Dept. MF, 625 Main St., Westbury, N. Y.

This data sheet describes Model G-5001, a 40-KC, 500-watt average output SonBlaster generator designed for energizing a wide range of cleaning tanks, and the G-5002, a 20-KC 500-watt average output generator which will operate magnetostrictive transducers for such functions as drilling, dip soldering and other high-intensity or high-temperature applications.

In addition to complete data on the 23 systems of the Series 5000, detailed information is given on applications and processes for which this equipment can be used. Tanks of different sizes, submersible transducer arrangements and metal-working tools are illustrated.

Compressed Air Filters

Commercial Filters Corp., Dept. MF, 2 Main St., Melrose, Mass.

A new booklet has just been published to describe a complete line of filters for compressed air and other gases. It includes several single tube models for operating pressures from

below 125 psi up to 4,000 psi, and flow rates as high as 800 scfm. The booklet includes technical information and charts on flow characteristics, physical dimensions, and metals in which the filters are made.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Golden Jubilee Convention

Wright Wilson will be the general chairman of the Golden Jubilee Convention to be held in Detroit, Mich., June 15-19, 1959.

Mr. Wilson has been a member of the Detroit branch for over twenty years and has held every office in the branch except Librarian. He was president in 1947 when Detroit hosted the 34th Annual Convention and the first Industrial Finishing Exposition.

He is also a member of the American Society of Metals, the American Society for Testing Materials, the Engineering Society of Detroit, and the Electrochemical Society. He has served as local section chairman of the latter, and was general chairman of its 100th meeting, held in Detroit in 1951.

Wright Wilson

Mr. Wright, who resides at 1570 Anita, Grosse Point, Mich., is employed at the Chrysler Corp. Missile Div. as supervisor of metal finishing in the Chemical and Metallurgical Production Engineering Section.

Lancaster Branch

The regular meeting took place Nov. 14th at Aircraft Marine Research Laboratory, Harrisburg, with 26 members and two guests present.

During the business meeting, mimeographed copies of revisions and changes of the Society by-laws were distributed. One new member was approved: *Martin S. Frant.*

The educational program consisted of an excellent talk on salt spray testing of copper plated parts, given by Mr. Frant, research associate of Aircraft Marine Products, Harrisburg, Pa.

I. Paul Sharretts
Secretary

Blue Ridge Branch

The regular monthly meeting was held Nov. 7, 6:30 P.M. at the Hut restaurant near Martinsville, Va., with *T. R. Boggess* presiding. *W. J. Miller, III*, of Proctor Electric, Mt. Airy, and *Joe J. Cherry* of F. H. Ross, Greensboro, were elected to membership.

Art Kohler, technical director of Frederick Gumm Chem. Co., spoke on "The Role of Medium and Compound in Barrel Finishing." Art exhibited and explained use of each type of tumbling

media, their forms and purpose. Samples were shown illustrating the results of combinations of media. Methods of test tumbling were given.

Carl Witherspoon
Secretary-Treasurer

Baltimore-Washington Branch

The November meeting was held November 12, 1958 at the Naval Gun Factory in Washington, D. C. Members and their guests enjoyed cocktails from 6:00 to 6:30 and a delicious steak dinner followed. The cocktails and dinner were served in the Officers' Mess.

Captain Simpson and *O. W. Tomlinson* welcomed the members and their guests and explained that the Naval Gun Factory Plating Dept. has been undergoing a gradual change from the heavy plating of gun barrels and mounts to the plating of rocket and missile parts and the finishing of aluminum.

Dr. Gwendlyn Wood, local president of *The Electrochemical Society*, invited the members to a dinner held on November 20, 1958, at the Brook Farm Restaurant, Chevy Chase, Md., to honor *Dr. William Blum* as the first recipient of the William Blum award of the Baltimore-Washington Section of The Electrochemical Society.

George C. Pierpont, general manager, Pier-Sol Co., Baltimore, Md., was elected to membership.

A conducted tour of the plating department followed. Unique among the various processes exhibited was the method of plating the bore of the 18 inch naval guns.

Harold W. Scott
Secretary

Buffalo Branch

The November meeting was held on Friday, November 7 at the regular meeting place, the Niagara Manor.

A major portion of the business session was devoted to reports of progress to date on the 5th Empire State Regional Meeting to be held April 11, 1959 at the Hotel Stuyvesant, Buffalo, N. Y. Committee reports were given by *Frank Rudolph*, general chairman; *John Scholterer*, program chairman; *Robert Lienert*, publicity chairman; and *Harold Shapiro*, educational chairman.

After the business session, *John Donaldson*, librarian, introduced the speaker of the evening, *Robert T. Gore* of Metal & Thermit Corp., whose subject was "Wire Plating." Mr. Gore discussed the general principles applying to wire plating, placing special emphasis on the differences in technique between continuous wire plating and conventional still tank plating. Application of metal coatings to wire such as tin, tin-lead, brass, bronze, copper, nickel and zinc was also discussed.

The February meeting will be held the first Friday of the month at the Niagara Manor. The speaker will be *Eliot Gessman* of Olin-Mathieson Corp., whose subject will be "Plating on Hard to Plate Base Materials."

Robert E. Lienert
Secretary

Los Angeles Branch

A panel discussion on copper plating, with four members of the branch serving as panelists, attracted 85 members and guests to the November 12 meeting, which was held in Rodger Young Auditorium, Los Angeles.

Exposing themselves to a barrage of controversial questions dealing with

copper plating practices were *Milton Weiner* of the Weiner Laboratories, Whittier, Calif.; *Glen Beckwith* of American Buff Co.; *Oscar Grissat* of Atlas Hardware Co.; and *Don Baudrand*, plating analyst and consultant. *Emmett H. Babcock* of Convair, Inc., Pomona, served as moderator.

The questions came thick and fast and seldom were the panelists "stumped" except on a rare occasion when a veteran plater fired a question about copper plating technique in vogue 40 or so years ago.

Participating in the lively two-hour discussion were such authorities on copper work as *Don Bedwell* who had been an active plater for 45 years before his retirement in 1957; *Myron Orbaugh* of the Bone Engineering Co.; *Earl Coffin*, a job shop operator for 25 years before he entered the supply selling end of the business; *Al Sulzinger*, *Claude Weely*, *Ed Wells*, *Ray Bray*, and others.

Questions fired at the panel dealt with the operating costs of copper, the buffability of copper plate, how does the control of normal cyanide bath compare with the control of pyrophosphate bath; does copper sulfate or copper cyanide give better throwing power (the panel spoke up for cyanide on this point)?

Membership Chairman *Frank Virgil* submitted the applications of *Don Schockly*, process engineer with Turnkey Engineering Co., South Gate; and *Edward King* of Alert Supply Company, Los Angeles.

Guests included *Gerald Perrin* and *Delmar Gardner* of North American Aviation, Inc.; *James Gregson* of Modern Plating Co.; *F. E. Jacobs* of Coast Engineering Co.; and *Joseph Molino* of L. H. Butcher Co.

Ed Wells of the Crown City Plating Co. reported that *Harold Kroesche* of Harshaw Chemical Co., a member of the branch for more than 20 years, had been confined to the Good Samaritan Hospital in Los Angeles since early in October. Harold was reported to be suffering from a lung ailment and has been under oxygen much of the time.

Chicago Branch

The monthly meeting was held at the Western Society of Engineers on Friday, Nov. 7, at 8:00 p.m. Six new members were elected to the branch. An early reminder, the annual educational session and banquet will be held at the Conrad Hilton Hotel on Saturday, January 31, 1959. Librarian *Joseph C. Corre* and committee have arranged for the following to give talks: *Myron Diggin, Dr. M. M. Beckwith, C. H. Sample* and *Dr. R. B. Saltonstall*. The following subjects will be discussed (1) Nickel electroforming, (2) Duplex nickel plating, (3) Protective value of nickel and chromium in bright deposits, (4) Modern bright nickel as a finishing tool. The banquet committee, under the chairmanship of *Ray Ledford* and *Christopher Marzano*, have arranged a good floor show for the members and guests.

The guest speaker was *Barney C. Case*, supervisor of finishing operations at the Sunbeam Corp. in Chicago, Ill., who spoke on "The Pre-Finishing of Thin-Gauge Metal." Mr. Case discussed the methods that are used in flat-polishing lines, both the wet method and the dry method.

A very lively question and answer period followed and he was warmly thanked for his very informative talk.

Christopher Marzano
Publicity Chairman

Waterbury Branch

The November meeting was held as usual at the Roger Smith Elton Hotel on Thursday, November 13. Several topics of general interest to the branch were discussed and announcement was made of a pending business meeting to be held at the hotel so as to encourage greater attendance.

Technical Chairman *Bill Innes* introduced the speaker, *Dr. R. B. Saltonstall*, who proceeded to deliver a very fine paper on the factors effecting corrosion resistance of copper, nickel and chrome systems.

Waterbury Branch is the host for the coming New England Regional with *Ed Garland* the general chairman. Plans are already being laid for this meeting to be held April 18, 1959.

The Branch voted to subscribe $20 as its share of a Sustaining Membership to be bought in the name of the 19th N.E. Regional Meeting.

F. A. Schneiders
Publicity

St. Louis Branch

The regular monthly meeting was held at the York Hotel November 12th with 26 people for dinner. The business session was called to order by the President *William George* with 34 members and guests present. *Wayne Gregory* of Sommers Bros. Mfg. Co. was accepted as a new member. The committee reports were dispensed with for this meeting and, as there was no further business, the meeting was turned over to Librarian *Arthur Wrisberg*, who introduced *Dr. Henry Brown* of the Udylite Corp., presenting a talk on "Corrosion Studies with Nickel-Chromium Plate." His talk was accompanied by slides showing the effects of corrosion. The talk was followed by an active question and answer period. Dr. Brown was given a rising vote of thanks for his excellent paper and the meeting adjourned at 9:30.

Ward Kelly,
Secretary.

Indianapolis Branch

Fifty members and guests of the branch met at Fox's Steakhouse on November 3rd, 1958, for the monthly meeting. After the customary introductions, Branch Librarian *Paul Johnson* introduced the speaker of the evening, *Russ Vandenberg* of the Aluminum Co. of America, who spoke on aluminum anodizing. In his talk, Mr. Vandenberg discussed and demonstrated the formation of the anodic coatings on aluminum, the solvent effect of the various electrolytes on the final coating and the effect of various alloying constituents on the color of the coating. The talk was illustrated by slides and the Alcoa movie on color and texture in aluminum finishes was shown. Following this, a question and answer period was held, and many questions were asked and answered.

John Hood, branch president, then opened the business meeting. A new member, *Alfred Darnell*, was accepted by acclamation.

Les Reynolds, senior branch representative to the Tri-State, reported that a meeting of the Tri-State Committee would be held in Louisville on November 8th, and that he would be in attendance. He stated that the Indianapolis Branch must elect a junior member to the Tri-State before the April 4th meeting of the Tri-State.

A motion was made and carried that the dinner meeting be set for 7 p.m. CDST, instead of 6:30 p.m., to make

it easier for the men who are working by standard time to attend.

The meeting adjourned at 10 p.m.

A. M. Howard,
Secretary

Grand Rapids Branch

The branch held the November 14 meeting in the Trader's Room of Scotties Restaurant. The 71 members and guests present were served delicious beef dinners, followed by a brief business meeting. Three new members voted into the society at the November meeting were *Alfred B. Watson* of Light Metals Corp., *Charles E. Stewart* of Bohn Aluminum, and *George A. Fournier* of Kelite Corp.

Librarian *Orville Hoxie* introduced the distinguished speaker of the evening, *Russel Vandenberg*, Head of the New Finishes Division of the Aluminum Co. of America. Mr. Vandenberg first reviewed the current finishing trends on aluminum and aluminum alloys. He then discussed modern methods of anodizing, showing some excellent slides diagraming the three basic structures of anodic coatings, and analyzing each in its method of formation and function. Some excellent photomicrographs were shown, distinguishing the difference in alloy and coating density as related to corrosion resistance and brightness. An excellent movie provided by the company was then shown, very dramatically pointing out present and potential uses of anodized aluminum.

Interest in the subject was dramatized by an exceptionally lively question and answer period. After adjournment, members enjoyed refreshments and interesting conversation.

Thomas C. Henner
Second Vice President

Indianapolis Branch

Inclement weather kept the attendance of the December 1st meeting to 22 members and guests. After the introduction of members, *Paul Johnson*, branch librarian, introduced the speaker, *P. E. MacAllister* of the MacAllister Machinery Co., who spoke on the highway system of Indiana.

John Hood, branch president, then opened the business meeting. The minutes of the last meeting were read and approved and the treasurer's report was accepted. A new member, *Leon Deer* of the Naval Avionics Facility, was accepted by acclamation. A report was made by *Les Reynolds* on the recent Tri-State Region Committee meeting which was held in Louisville. As the scheduled April meeting of the Branch also falls two days after the Tri-State meeting at Louisville, the possibility of changing this particular meeting night was referred to the Board of Managers.

The meeting was adjourned at 10:10 p.m.

A. M. Howard
Secretary

British Columbia Branch

The November 19 meeting took place at the White Spot Dining Room, 25th and Cambie Sts., Vancouver, B. C., with thirty members and guests present. Vice-President *Gordon Smith* acted as chairman in the absence of President *Jim Lee*. Three new members were elected, *Bob Lyhne*, *Tom Wallington* and *Ian Peacock*.

Walter Kellerman reported that, after many unsuccessful attempts to increase the attendance, it was necessary to discontinue the night school

course for this year. It will be possible to have a course next year, but Walter felt that it would be necessary to start preparations and publicity at a much earlier date than we have done in the past.

After the business part of the meeting we all enjoyed viewing a sound color film entitled "Song of the Clouds" which had been generously provided by the Shell Oil Co. This film dealt with various aspects of commercial flying as well as an insight into the complexities of air traffic control as they exist today. The meeting came to a close at 11:00 p.m.

Nelson Shepherd

SOCIETY OF VACUUM COATERS

The fall meeting and Technical Conference was held at the Statler Hotel, Detroit, Mich., on Nov. 5 and 6, 1958.

At the meeting, attended by approximately 150, an executive committee was elected, consisting of *Robert A. Feid*, B & T Plastic Finishing Co.; *Robert A. Gray*, The New York Air Brake Co.; and *William Pahl*, Ford Motor Co. The committee chairmen are: Program (Facilities), *F. Gruen*, Syn-Cote Chemical Corp.; Program (Technical Paper), *J. Scharnburg*, Bee Chemical Co.; Publications, *T. LaBounty*, Midwest Technical Sales.

The executive committee requested papers for the next meeting, to be held in January, 1960, in New York City, on the technical and practical applications and techniques involved in functional and decorative vapor deposition. Those interested are asked to send a 100-word abstract to *J. Scharnburg*, program chairman, Bee Chemical Co., 12933 So. Stony Island Ave., Chicago 33, Ill.

A booklet containing the technical papers presented at the 1958 Meeting is available at $10.00 per copy from *Robert Lux*, Society of Vacuum Coaters, P. O. Box 3095, Cleveland 17, Ohio.

N. A. M. F.

Three Chicagoans and one Washington metal finishing executive were named to the board of directors of the National Association of Metal Finishers.

Arthur G. Pierdon, president of Art Metal Finishing Co., Inc., Washington, D. C., was appointed to fill the unexpired term of *Amos Judd* of Baltimore, Md. who resigned recently because of ill health.

Other new members of the board include Windy City metal finishers *Robert L. Giesel*, Adolph Plating, Inc.; *J. William Carlson*, Arrow Plating Co.; and *William R. Crawford*, Chrome-Rite Co. They were named to fill the unexpired terms of the following interim appointees by the Chicago Electro-Platers' Institute: *H. W. Baker*, Electro-Galvanizing Co.; *L. J. Hay*, Plating Service Co.; and *P. J. Ritzenthaler*, Plating Engineering Co.

ULTRASONIC MANUFACTURERS ASSOCIATION

At the annual meeting of the association held at the Hotel Cleveland in Cleveland, Ohio, on Wednesday, October 29, the following members were elected to the board of directors:

Norman G. Branson, president, Branson Ultrasonic Corp., Stamford, Conn.

Harvey B. Foulkes, chief engineer, Cavitron Equipment Corp., Long Island City, N. Y.

Stanley E. Jacke, supervisor of re-

search and development, Detrex Chemical Industries, Inc., Detroit, Mich.

Jack T. Welch, assistant vice president, Sheffield Corporation, Dayton, O.

Following the annual meeting, the members of the new board of directors met and elected the following officers for the coming year:

Jack T. Welch, president (re-elected for a second term).

Norman G. Branson, vice president.

Robert L. Rod, secretary (re-elected for a second term).

Stanley E. Jacke, treasurer.

Plans were formulated for the next annual meeting of the association which was held at the Hotel Sheraton in Chicago on November 3 and 4, 1959. In addition, there will be approximately four interim meetings of the board of directors and of the engineering standards committee and approximately two such meetings of the fair practices committee.

AMERICAN SOCIETY FOR ABRASIVES

The Detroit chapter met October 30, 1958 at the Junior Auditorium, E.S.D. Rackham Building. *Warren K. Seward*, supervising engineer of new markets and application development of the coated abrasives division of the Carborundum Co., spoke on the common sense approach to coated abrasives and dealt with stock removal, tolerance and finish, new developments, and the future outlook for coated abrasives.

The following have been nominated for office for 1959: President: *Emil Vogely;* 1st Vice Pres.: *Fred Schlie;* 2nd Vice Pres.: *Edward R. Sorensen;* 3rd Vice Pres.: *John Gills;* Treasurer: *Dennis Hurley, Jack Hucklins.*

The chapter plans to amend its by-laws to make the office of secretary an appointive one. The amendment will be submitted to the national board of directors.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Seventy-nine companies have reserved 103 booths at the 1959 Corrosion Show to be held March 17-19 at the Sherman Hotel, Chicago. The show will be held concurrently with the 15th Annual Conference of the association. Some of the exhibitors will be returning to the show for the fourteenth time, having participated in every show sponsored by NACE since the first exhibition was held.

News from California

By Fred A. Herr

After 28 years with the Pacific Enameling & Plating Co. in Los Angeles (the last 10 years as plating supervisor) *Harry Callas* recently joined Newport Plating Co. in Newport Beach, Calif., as plating department manager.

He reports that, while the Newport firm, until recently, has been active chiefly in metal finishing marine hardware, arrangements are now being made to expand operations into the field of plating electric components to provide service to the growing electronics industry of Orange County.

Callas disclosed that, in November,

a pilot installation had been set up in the Newport shop for plating on aluminum. A full-scale aluminum plating division was to be installed shortly after the first of the year. The company's facilities for marine hardware plating include copper, nickel, chromium, cadmium, and zinc.

Don Shockley recently resigned as research and process engineer for the Los Angeles branch of Hanson-Van Winkle-Munning Co. to assume the post of manager of engineering for the Turnkey Engineering Co. of South Gate, Calif. *Jesse Andreson* is president, and *James Shaw* vice-president of the recently reorganized concern which specializes in design and installation of large plating systems on the so-called "turn-key" basis, among other activities outside the metal finishing field.

Glen Beckwith, sales engineer in Southern California for the American Buff Co. of Chicago, moved in distinguished circles recently when he was delegated to represent his alma mater, Case Institute of Technology in Cleveland, at the installation of *Dr. Paul Kern* as sixth president of the University of California at Los Angeles.

The distinction fell to Beckwith in his role as incumbent president of the Case Institute Alumni Association of Southern California. More than 300 universities and colleges throughout the world sent representatives to the ceremony, including some from Russia and other behind-the-iron-curtain schools of learning.

Dates for the 11th Western Metal Exposition and Technical Congress of the American Society for Metals have been announced as March 16 to 20, 1959, in Los Angeles. The machinery and technical educational displays will again be centered in the Pan Pacific Auditorium, where the officially clocked attendance in 1957 was 73,858. Technical sessions will be held in the Los Angeles Ambassador Hotel. All exposition matters, including allotment of exhibit space, are being handled through the office of *Chester L. Wells* in ASM headquarters, 7301 Euclid Ave., Cleveland 3, Ohio.

Titanium for Chemical Processing Equipment was the subject of a talk presented at the 38th national meeting of the American Institute of Chemical Engineers at Salt Lake City, Utah, recently, by *R. W. Wirta* of the General Electric Co., Richland, Wash.

A district sales office has been opened at 333 Montgomery St., San Francisco, by the Metals Division of Mathieson Chemical Corp., with *Paul T. Persons* as district manager. The company's West Coast regional office is located at 3243 Wilshire Blvd., Los Angeles. *John A. McDorman* is regional manager and *Robert R. Johns* Los Angeles district manager.

Harvey Aluminum Co., Torrance, Calif., reports the appointment of an advisory team to advise the chemical industry in the use of titanium. Members of the team will supply technical assistance to manufacturers of processing equipment to stimulate new product applications for titanium.

The Neal Fay Company of Santa Barbara, Calif., has completed construction on a new plant near Goleta, Calif., which is equipped for designing and manufacturing precision dials,

slide rules, ballistic scales, circular computers and other precision built measuring instruments. The facilities include equipment for an anodized facsimile process known as Anofax with which the graduations and markings on precision instruments are applied.

A $100,000 expansion program has been undertaken by King Anodizing Co. of Burbank, Calif., to handle the work in connection with the firm's recent appointment as contract applicator in Southern California for the Sanfordize industrial and architectural aluminum hard finishing process. The process is described as possessing excellent abrasion and corrosion resistance and to have excellent values for salt exposure and color change under severe conditions.

The National Institute of Jig and Fixture Component Mfrs. was organized at a recent meeting in Los Angeles and includes among its membership representatives of the principal manufacturers of jig and fixture components in the United States. Officers elected include *Erick W. Bergmann*, president; *John Burke*, vice-president; and *Harold Wrigley*, secretary-treasurer.

A talk by *William Kampfer* of the Titanium Pigments Corp. on "Factors Influencing The Behavior of Titanium Pigments in Industrial Finishes" featured the educational session of the November 12 meeting of the Los Angeles Paint & Varnish Production Club.

Mr. Kampfer gave an interesting demonstration of formulation technique with respect to hiding power efficiency by blending equal volumes of two paints made at 15% PVC and 45 PVC, both prepared at equal solids by volume. The resulting paint at 30% PVC had higher hide than either of the others.

Curves were shown wherein the gloss relationship of a given system was super imposed on the hiding efficiency family of curves. The speaker also exhibited a graph illustrating hiding power as a function of particle diameter. Of interest, too, was a chart showing evaluation of various vehicle systems with respect to color change between the normal bake and an overbake.

G. B. Levan recently was appointed general sales manager for the titanium and special metals division of the Mallory-Sharon Metals Corp. and is in charge of sales on the West Coast and other areas. It was also announced that *A. N. Eshman* has been named to direct sales development in aircraft and missiles field.

Pickling equipment for stainless steel assemblies, chemical cleaning facilities for aluminum parts, and a 30 foot edge planer for machine edge preparation of pressure vessel plates are included in the equipment of a new $500,000 plant for manufacturing and engineering facilities for alloy fabrication which was opened recently in Los Angeles by the Standard Steel Corp.

Known as the Cryogenics Division, the new plant will fabricate large vacuum bottle type low temperature fuel tanks for the missile industry. *Roy C. Heacock*, formerly director of engineering for Alexson Mfg. Co., Los Angeles, has been named plant manager.

OBITUARIES

HARVIE J. JOHNSON

Harvie J. Johnson, vice president of Belke Mfg. Co. and a member at large of the American Electroplaters' Society, died in Springfield, Ohio on November 28th, 1958, age 59.

A resident of Chicago, Harvie had been associated with the company and the plating industry since 1932. Surviving are his widow, Lillian, a sister, Florence, and a brother, Roy, who is also associated with the plating industry.

AGNES HOEFER

As we go to press, we are saddened to learn of the sudden death of *Agnes Hoefer*, wife of *August Hoefer*, vice president of Frederic B. Stevens, Inc. We offer our sympathy to the family.

PATENTS

(*Continued from page* 71)

Electroless Nickel

U. S. Patent 2,837,445. *June* 3, 1958. *P. Talmey and D. E. Metheny, assignors to General American Transportation Corp.*

In the continuous process of chemically plating with nickel articles essentially comprising an element selected from the group consisting of iron, cobalt, nickel, aluminum, copper, silver, gold, palladium and platinum; wherein said articles are contacted with a bath comprising an aqueous solution of nickel ions and hypophosphite ions and lactic ions and propionic ions; and wherein said bath initially comprises an absolute concentration of hypophosphite ions in the range 0.15 to 0.30 mole/liter, sufficient nickel ions to provide a ratio between the nickel ions and the hypophosphite ions in the range 0.25 to 0.60, an absolute concentration of lactic ions of about 0.30 mole/liter, and an absolute concentration of propionic ions of about 0.03 mole/liter, and said bath has an initial pH in the range 4.5 to 4.8; the method of regenerating said bath as the continuous plating process proceeds comprising progressively adding thereto nickel ions and hypophosphite ions and lactic ions and propionic ions, whereby said progressive additions of nickel ions and hypophosphite ions are such as to prevent the depletions thereof in said bath as the continuous plating process proceeds and said progressive additions of lactic ions and propionic ions are such as to increase the concentrations thereof in said bath as the continuous plating process proceeds, wherein said additions of lactic ions and propionic ions are related to said addition of nickel ions so that about 0.03 mole of lactic ions and about 0.005 mole of propionic ions are added to said bath to each 0.08 mole of nickel ions added thereto.

Sand Blasting Apparatus

U. S. Patent 2,837,874. *June* 10, 1958. *E. D. Hunter.*

A sand blasting apparatus having a sand receiving element and a nozzle for dispensing the same having an air cut-off valve carried thereby, the sand receiving element having positioned therein an air jet directed toward its outlet, a flexible air supply line leading directly to the said nozzle from a suitable supply source, a flexible sand supply line leading from the sand receiving element to the nozzle, and a flexible air line leading from the nozzle to the air jet in the sand receiving element and being connected with the nozzle outwardly toward the exhaust end of the nozzle and beyond the air cut-off valve.

Coating Conveyor for Panels

U. S. Patent 2,838,023. *June* 10, 1958. *P. C. Jaime.*

An apparatus for applying a protective coating to a metal panel.

Spray Coating Machine

U. S. Patent 2,838,024. *June* 10, 1958. *P. Rekettye, assignor to The Sun Rubber Co.*

Apparatus for spray coating balls.

Nitrocellulose Coating

U. S. Patent 2,838,464. *June* 10, 1958. *W. K. Moffett and J. D. Pickens, assignors to E. I. du Pont de Nemours and Co.*

A liquid coating composition, which produces a dry light-colored coating characterized by resistance to discoloration from contact with oil, grease or tar, comprising lacquer grade nitrocellulose, alkyd resin modified with 25%-35% by weight of a member of the group consisting of coconut oil and coconut oil fatty acids as the only oil modifier in said resin, polyester plasticizer of the class consisting of 2-ethyl hexanediol adipate, propylene glycol sebacate and propylene glycol adipate, and volatile organic solvent, said plasticizer having a boiling point above about 325°C., having a solubility in water at 25°C. of less than 0.005% by weight, and producing a cloudy mixture when mixed with an equal weight of n-hexane.

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TECHNICAL SALES

SITUATION WANTED—I can offer you over 25 years experience in the metal finishing field. Thoroughly experienced in all phases of barrel plating, rack plating in all finishes; anodizing, polishing and buffing in both job shop and production plant operation. Interested in technical sales, or will act as manufacturers' agent. New England area. Address: January 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLANT MANAGER

SITUATION WANTED—Professional management engineer with graduate degree in Chemical Engineering desires position as plant manager. Wide experience in plating and plating plant management. Address: January 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

ANOTHER PLATING PROBLEM SOLVED BY SEL-REX!

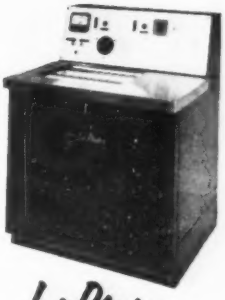
Cutaway view of W&T lantern showing automatic lampchanger and flasher mechanism.

WALLACE & TIERNAN SAVES 932 HOURS ON FIRST TWO JOBS WITH JET PLATER

Always alert to modern production methods, Wallace & Tiernan, Inc., Belleville, New Jersey, have realized almost incredible savings in production-time with their SEL-REX JET PLATER—the complete plating "plant" in a single compact package.

"Electroplating of flasher and lampchanger components used in Wallace & Tiernan's Aids To Navigation has always been an important part of our production," says Mr. C. W. Davis, Manager, Mechanical Manufacturing. "That's why we're so pleased with the substantial savings in production-time since we installed our JET PLATER. In addition, together with the Sel-Rex Bright Gold Process, we are now getting a Gold Plate superior to any we had ever produced before."

Whatever your plating problem — precious metals, power, equipment or procedures — Sel-Rex Representatives are trained to "Custom-Engineer" solutions to our mutual profit. Send for FREE technical data and other case histories, and see for yourself... we may have solved *your* problem last month.



Jet Plater

Complete electroplating "plant" in 34" x 28" x 33" cabinet.

Sel-Rex®

SEL-REX CORPORATION

NUTLEY 10, NEW JERSEY

Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies

THE COMPANY THAT HAD NO FACE . . .

37 years in the metal finishing business, and it didn't have a face. When it glanced in a mirror, a *customer's* image reflected back; when it spoke at conventions and sales meetings, it spoke the words of a *customer;* when it listened to industry problems, it listened with a *customer's* ears. This company measured success in terms of its *customer's* success. Still does today.

MacDermid

...right to the Finish!

MacDermid Incorporated
Waterbury, Connecticut, PLaza 4-5171
Ferndale, Detroit, Michigan, LIncoln 5-0064
MacDermid Pacific, Torrance, California, DAvis 3-6292

MacDermid Incorporated *still* believes customers are in business to make money. We help them. They're loyal to us *for one good reason:* MacDermid compounds—coupled with experience in *all* phases of metal finishing—improve your products, reduce rejects, step up efficiency, increase profits. That's what our customers are in business for; that's what *we're* in business for. We depend on each other for success.

MANUFACTURERS OF METEX METAL FINISHING COMPOUNDS